MAY 16, 1960

American Machinist / Metalworking Manufacturing

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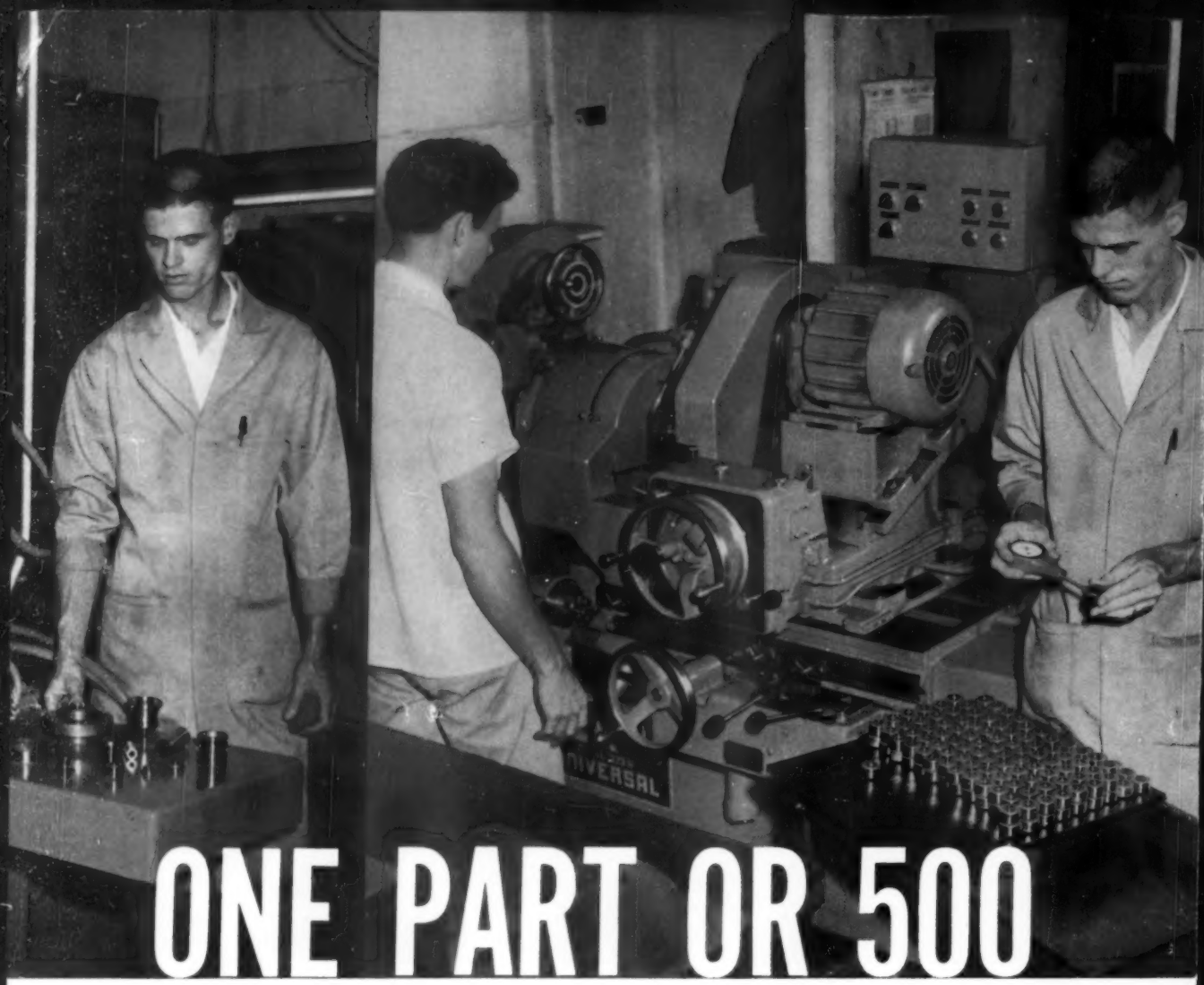
Micrometers check gap space for Boulder cyclotron — see page 1

SUB-ZERO MACHINING

Special Report, page 109



ONE PART OR 500

Selco gets top grinding performance at rock-bottom cost with the

NEW HEALD MODEL 273A UNIVERSAL

The Heald Model 273A Universal Internal Grinder shown above is installed at the Selco Grinding Company — a small but busy job shop in southern California. Here it is used to grind straight or tapered I.D.s and O.D.s, and for rotary surface grinding of flat, convex or concave surfaces of a wide range of work — from individual parts to production runs. And it easily handles every job with far greater speed, accuracy, precision and finer finish than could be obtained on any of their previous equipment.

Until the advent of this Universal Grinder, most small job shops (and many larger ones, too) couldn't afford a machine of this type. But the Heald 273A costs about *half* as much as comparable machines today, and less than similar machines (with fewer features) cost in 1947!

Incorporating the latest advances in the grinding art, it holds tolerances to within .0001″ in routine production, and within .000050″ in special cases. Features include hydrostatic antifriction ways, full 20″ table travel, several wheelhead positions, infinitely variable workhead speed from 150 to 450 rpm and 90 degree workhead swivel for rotary surface grinding.

Ask your Heald engineer for information on the New 273A — the only completely new machine with 1960 performance and a 1947 price tag.

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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HEALD

It PAYS To Come To Heald

CIRCLE 151 READER SERVICE CARD

American Machinist / Metalworking Manufacturing

COVER:
Inspectors at Bethlehem Steel Co check pole faces for University of Colorado research cyclotron within 0.004 in. for parallelism and 0.001 in. for concentricity.

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TURN PAGE FOR METALWORKING REPORT—▶

METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

Off-Shelf Specials

Vertical-spindle turning machines, assembled to order as special machines from standard components, are being produced by Motch & Merryweather, Cleveland. Basic aim is to provide a special machine at minimum cost and delivery time, and to provide for retooling by substitution of standard elements.

The concept has developed out of previous vertical turners M&M has built on special machines. Basically the machines consist of a standard spindle hung on the front of the base and a column mounted to the base with a precise relationship to the spindle. The desired operating slides can then be mounted in any position on the column by drilling an appropriate hole pattern in the face of the column.

The machines can be built with one, two, or three spindles because two base sizes are available, which can be used singly or in combination. Time to engineer and assemble one of the special machines is ten weeks, but Motch & Merryweather expects to reduce this to seven or eight weeks.

FORMING

Automation for Cabinet Bending

An upright 4-post tangent bender is the key to automated production for home-laundry cabinets on a combination press and welding line. The bender is built like a press so the flat cabinet sheet with flanged edges can be turned up into U shape, then passed straight through the machine to the next operation.

The line was developed by Taylor-Winfield Corp, Warren, Ohio, for an appliance manufacturer. Sheets are destacked, blanked, punched, flanged, U-formed, and embossed. Then corner gussets, top braces, and struts are fed mechanically to position and spotwelded into the box.

After destacking, an idle station centers the sheet and senses that there is just one sheet in position before the sheet is fed to a 300-ton punching and notching press. A second 300-ton press does the flanging all around. Then the cabinet wrapper is fed from an idle station to the tangent bender. Upper tooling is fastened to the crown; the lower clamp and rocker dies to a moving member below.

After wing forming, the work is transferred to a special hydraulic forming machine that produces the built-in flanges and corner embossments.

FORMING

Formed by Nitrogen

Explosive forming by several methods has captured the imagination of American engineers, especially in the aviation and missile industries. But the Soviets have not been idle. They claim that parts can be formed in dies, or bulged, by use of liquid nitrogen.

A shock-type expansion is created, it is claimed, by allowing liquid nitrogen to expand at room temperature. The transition from the liquid to gaseous state occurs in one second. One liter of liquid yields 609 liters of gas. Pressure buildup to 8500 psi is reported.

In the Russian setup, the flat metal strip or sheet is laid onto the lower die and a hermetically sealed lid is clamped on top. Piping, metering and vaporizing equipment are connected to the lid. After expansion, the gaseous nitrogen is pumped off and reused (evidently it is cooled and compressed to the liquid state).

INSPECTION

Portable Spectroscope

Most spectroscopes are large pieces of laboratory equipment to which a metallic sample must be taken from the shop. The sample is sputtered in an electric arc, and the light rays emitted in the arc correspond to the elements present in the alloy. Both qualitative analysis (kinds of alloys present) and quantitative analysis (percentages of each alloy in the sample) can be made quickly.

The same kind of checks can now be made with a hand-held instrument. Outdoor and indoor use is practical, and the exteriors or interiors of parts, structures, or castings can be checked.

The RDM spectroscope is a product of VEB Rathenower Optische Werke, Rathenow (D.D.R.) A transformer box, operating on 220 ac, supplies current at 25-40 v to the "gun." When the tungsten electrode is touched to the metal object, an arc is created.

The light from the arc passes through a prism to create the desired spectrum, which is viewed through an eyepiece. By means of a graduated collar, the eyepiece is focussed to one portion of the spectrum only (the dispersion is too great to see the whole spectrum at once). By turning a button, the spectrum lines are made to pass a fixed mark in the viewing field. A scale with magnifier enables one to coordinate each spectrum line to a definite value or wavelength.

Stable Gage Blocks

As part of the National Bureau of Standards' efforts to achieve accuracy of 1 part in 10 million for gage-block calibrations, scientists have been working on development of more stable blocks. Three types of blocks, developed by M R Meyerson, show dimensional stability considerably greater than the best commercial blocks, it is said.

The most stable blocks were made of annealed 410 stainless steel, nitrided to a depth of 0.009 in., ground to within 0.003 in. of finished size, stress relieved at 975 F for 3 hr in cracked ammonia atmosphere, and lapped. The process left the blocks with a 0.005-in. case. Growth amounted to two-tenths of a millionth in a year.

The nitrided non-gaging surfaces

of the 410 blocks had a frosty gray appearance. A group of these blocks had the frosty layer removed by grinding, but similar stability was indicated.

Through-hardened 52100 steel was not quite as stable. Growth was fourtenths of a millionth in a year. These blocks were heat treated by austenitizing at 1550 F for 30 min., quenching in accelerated quenching oil, stabilized by refrigerating at –140 F for 18-24 hr, tempering at 250 for 1 hr, refrigerating again at –140 F for 18-24 hr and tempering at 250 F for 9 hr. The blocks were ground and stress relieved at 240 F for 3 hr before final lapping. This treatment reduces unstable austenite content to less than 2%.

According to the Bureau, commercial hardened steel blocks of AA grade showed a shrinkage of 0.0000007 to 0.0000019 in. per in. per year, or an average of 0.0000011 in. per in.

HEAT TREATING

Nitrided Titanium

Experiments at the Nat'l Bureau of Standards have shown that pure titanium can be nitrided successfully in pure nitrogen. The depth of case increases with the time of treatment in a parabolic relationship and consists of a surface film 0.0005 in. thick, covering a principal layer of 0.004 in. on specimens treated for 48 hr. After 168 hr, the total case thickness increased to 0.008 in. This is markedly different from the results obtained by nitriding in ammonia, where maximum case obtainable is 0.004 in., and further treatment reduces the case thickness.

The process is not applicable to titanium alloy Ti-6Al-4V because the surface layer is thinner than on unalloyed metal, and elongated nitride grains penetrate deeply into the core at a 45° angle with the surface. These act as stress raisers and seriously reduce the impact resistance, which is in no way affected on pure titanium.

WELDING

Wide-Gap Brazing

A new type of brazing alloy that can bridge joint clearances up to 1/16 in. with a dependable brazed joint is now commercially available. A big advantage is that it eliminates costly machining operations necessary to achieve the 0.003-in. clearance required for other types of brazing alloys (*AM*—Nov 3 '58, p96).

Developed by the Metallurgical Products Dept, General Electric Co (Detroit), the Wide-Gap Series is one of three new types of high-strength high-temperature brazing alloys for joining type 321, 347, and other stainless steels, as well as the super alloys such as René 41. The other two are: a general-purpose alloy for high-temperature brazing, and a honeycomb brazing alloy for thin-core materials (0.001 to 0.005 in.)

All the new alloys are produced by vacuum melting, which the Department says assures a cleaner alloy, essentially free from inclusions, undesirable impurities, oxides, and absorbed gases.

THE OUTLOOK:

The AM/MM Index of Metalworking Production has been holding steady at 108 (1957=100) for the past three months. Many segments of the industry are anxiously awaiting the upswing promised by reports of increased capital spending; some are wondering if it's coming at all. *For details, see page 81.*

ASSEMBLY

Semiconductor Automation

Assembly of diodes will be automatic at Amperex Electronic Corp's new Slatersville, R I, plant that will open this year. The company has a completely mechanized assembly machine.

Also announced is the strong probability that an automated assembly machine for transistors—the company's new post-alloy-diffused type—will be ready for production within two years. This has significance because it will lower transistor costs, and will also improve exact transistor quality control, which is normally difficult. Though a high proportion of production transistors will operate satisfactorily, exact properties cannot be determined until inspection after assembly. For this reason there are many more types (coded grades) than necessary.

Automated assembly should reduce the variation in properties and response, reducing the number of grades within each general type of transistor.

FINISHING

Strip-Stock Painter

Coiled aluminum stock in widths from 2 to 66 in. is being painted automatically by a line developed by Kaiser Aluminum, Ravenswood, W Va. The equipment unwinds the stock, cleans, rinses, chemically precoats, and rerinses. Stock is then dried and passed through paint rolls that coat one side or two, baked in a three-stage oven 100 ft long, quenched, and finally rewound into coils.

Called Kaiser Kote, the prepainted metal is available in many colors; will stand blanking, bending, crimping, and other operations without damage to the finished surface. Principal application is architectural, as in sun awnings and siding.

Camshafts are Barrel Finished

Burrs on the teeth of oil-pump gears integral with Vauxhall camshafts are removed by barrel tumbling in an unusual setup. Shafts are mounted in special fixtures attached to the doors of the barrel; 16 per door for four-cylinder models, 8 per door for six-cylinder models. Four doors are used on each barrel, with four spares that can be loaded while the others are in process. Spring clips cover the center bearing oil hole, and a rubber fillet, which is part of the jig, seals off oilways in rear and bearings. Loaded doors are rinsed in sodium metasilicate solution to remove surplus lubricant before loading into barrel.

Triangular ceramic chips are employed for deburring and remain in the barrel until worn beyond satisfactory limits, but water and compound are renewed for each load. Barrel speed is 19 rpm and normal time is 1 hr. Shafts do not move in respect to each other, but the media flows over and between them.

In addition to deburring the gear teeth, the process also cleans up the edges of the cams and journal but without significant radiusing.

MATERIALS HANDLING

Shock Fuse

Rough handling can now be detected after a package has reached its destination; an inexpensive shock-overload indicator by Convair In-

struments, San Diego, shows red if a load has been mishandled.

The detector is a small unit, 1½ by 1½ in., that can be mounted with sensitive equipment inside a crate, box, or any container. If the load is subject to shock over a pre-set amount, a spring-loaded mass trips to expose a red color spot behind a clear plastic cover. The device is sensitive to acceleration in one longitudinal direction and all transverse directions, so it may be oriented. Two units will detect shock in any direction.

Sensitivity may be adjusted, and can be made different in different directions. Cost is only $20 in lots of 1000.

Aging Oven Gets Lift

Pinched for shop space, a Chevrolet Motors plant recently relieved some of its congestion. The solution: Hang an aging oven from plant trusses, and use an inclined conveyor to deliver aluminum castings to the oven.

Space savings at Chevrolet's Aluminum Foundry Div (Massena, NY) amount to 4500 sq ft. Trucking and conveying are simplified, too.

The oven, which strain relieves aluminum castings, hangs only 8 ft below the roof trusses. An inclined conveyor picks up the castings at the cleaning department and delivers them to the overhead oven, which is 150 ft long and 30 ft wide. Timing of the oven's built-in handling system is synchronized with that of the inclined conveyor. Castings move through the oven on conveyor hooks, reach exit end after four hours of heat treatment.

MATERIALS & COMPONENTS

Higher-Temperature Aluminum

Extruded aluminum for higher-than-usual temperatures is being impact-formed from sintered powdered metal, according to Aluminum Co of America. One sample part is a ¼-in. tube with integral fins, which can also be produced in a spiral. The tube can be produced in lengths up to 14 ft, to dimension tolerances (on the tube wall) of 0.003 in., and with up to 10 fins. Applications are in atomic energy, aircraft, and missiles.

The AMP impacts are being produced at the Edgewater, N J, Alcoa plant. Result of combining impact extrusion with sintered powder metal is to raise the operating temperature range for precision parts.

Super-Pure Die Castings

Die castings of super-purity aluminum are being produced by the Nelmor Manufacturing Corp, Euclid, Ohio. The technique was developed by David Morgenstern, president of the company, in cooperation with Howard Fromson, president of Fromson Orban Co, Inc, New York City.

Lurium alloys, which are 99.99% pure aluminum, were used throughout the experimental and development processes to achieve a brilliant, homogeneous, high-finish casting. Anodized results achieved are said to produce the brightest finish ever obtained in a die casting, even exceeding that of chrome. After anodizing, the castings can be dyed to simulate gold, silver, platinum, or brass, as well as any color in the spectrum.

MANUFACTURING CONTROL

Keeping Tabs on Costs

It's difficult to keep costs in line with a budget, even when a plant has only one project. But a company that has 200 projects—each with its own budget—really has problems.

Thanks to a computer and a cathode-ray tube, one West Coast company now receives, only ten days after month's end, 200 graphs that show executives at a glance whether costs on each project are being held in line with the budget.

The Rocketdyne Div of North American Aviation, Inc, developed the program, which it calls ABC (Allocations for Budgetary Control). Here's the way it works: Cost details on each project are transferred daily to punched cards. At month's end, all data, put on magnetic tape, goes to a computer. Here the data is converted into graphic information and projected on a 7-in. cathode-ray tube, then photographed.

On each graph are two plots: one line represents planned expenditures, the other shows actual expenditures. For quick reference, the difference between the two lines is printed numerically.

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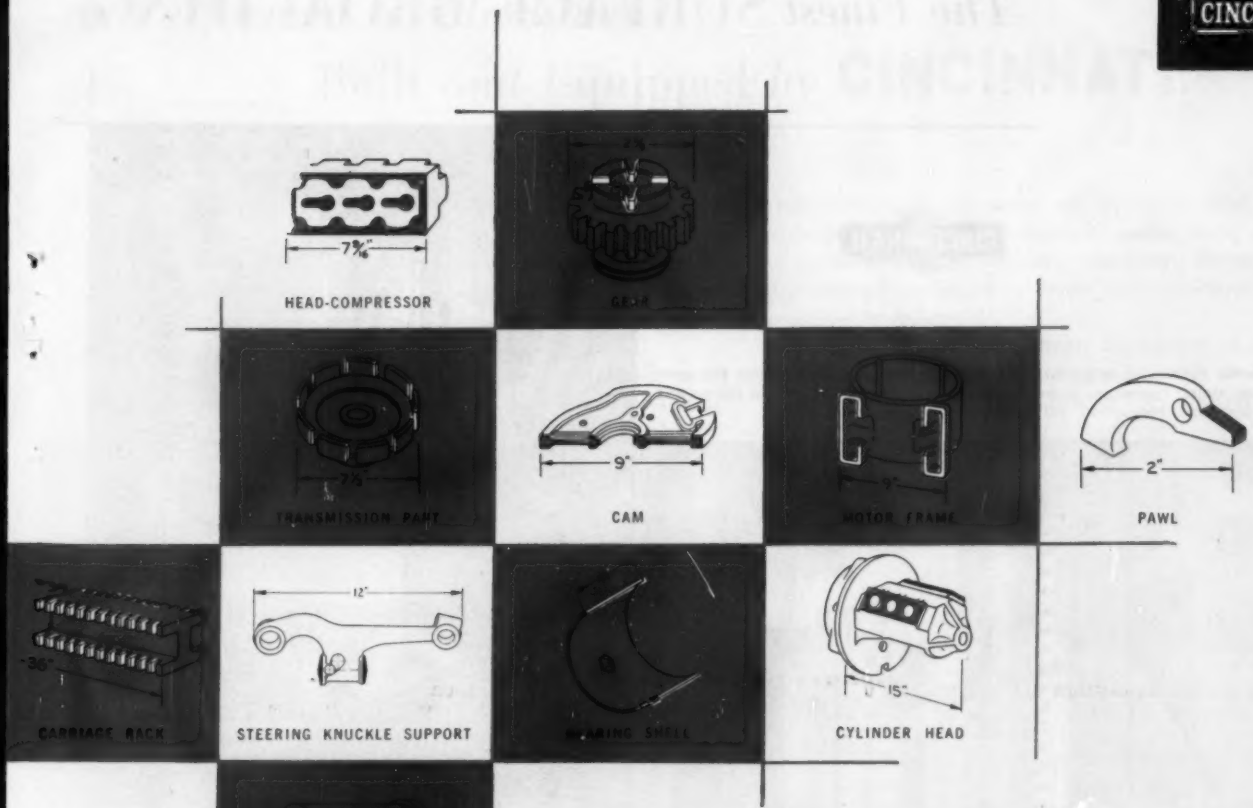

SURFACE BROACHING...

Requirements are simple, Possibilities unlimited

Have you thoroughly investigated the possibilities of surface broaching for your cost-reduction program? Surface broaching is faster and more efficient than many other machining methods; it improves accuracy and finish; requires less floor space; lengthens tool life. And its application is broader than you may realize:

- any part which allows cutter teeth to pass across the face of the machined surface, without interference from work or fixture, is logical for surface broaching.
- any part produced on a continuous basis, or nearly so, justifies initial tooling costs
- or, on a job lot production basis, families of parts can be broached profitably with interchangeable tooling
- several surfaces can be broached simultaneously, or in one or more settings of the workpiece
- even fragile or light parts can be tooled up to withstand the broaching thrust
- parts which cannot be tooled for broaching often can be redesigned to take advantage of surface broaching's economies

A variety of interesting examples are shown above and on the pages following. Cincinnati Surface Broaching Specialists will be glad to discuss applications in *your* shop. SPECIAL MACHINE DIVISION, THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO.

CINCINNATI
SPECIAL MACHINE DIVISION

MMT-PE
Booth No. 1034

Special Machines • Vertical and Horizontal Broaching Machines • Complete Production Lines

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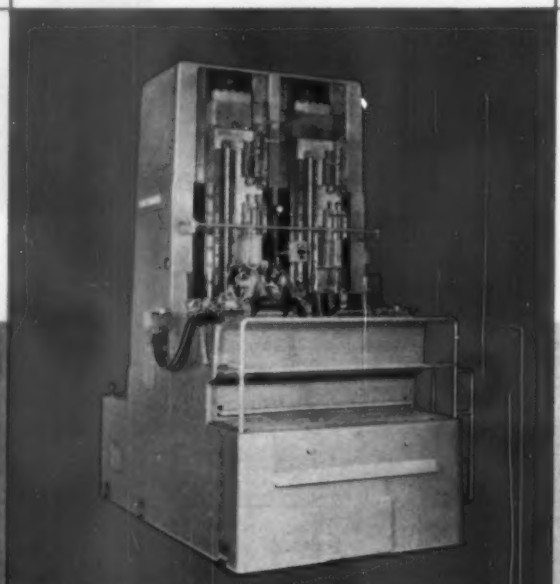
The Finest SURFACE BROACHING

CINCINNATI

Automatic fixtures on this CINCINNATI No. 15-66 Duplex Vertical give the operator an assist. Operation: broach half-bore, joint faces and slot in connecting rods and caps. Production, 102 pairs per 50 minute hour.



Cincinnati gives you a choice of Vertical and Horizontal Surface Broaching Machines, up to 27 tons broaching force for standard models. Unlimited broaching force for three special machines (one recently completed was powered with a 500 hp motor).

Single Ram Vertical, catalog M-1745-1
Duplex Vertical (illustrated), catalog M-1848-1
Horizontal, catalog M-1810

DESIGNERS AND BUILDERS OF SPECIAL MACHINES • VERTICAL AND HORIZONTAL BROACHING

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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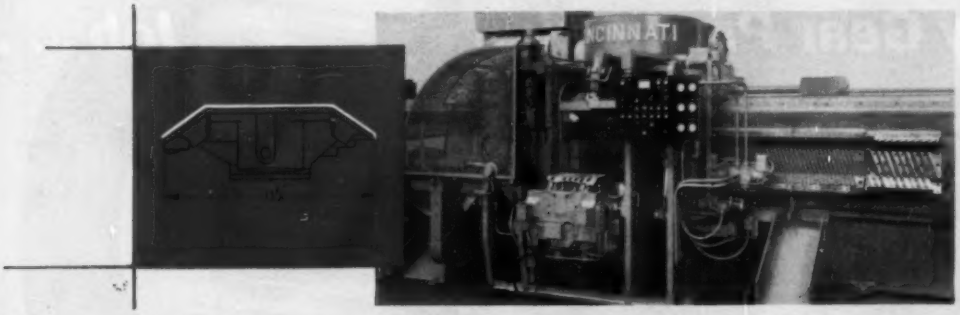
is Performed on Machines
Built *and* Equipped *by* **CINCINNATI**

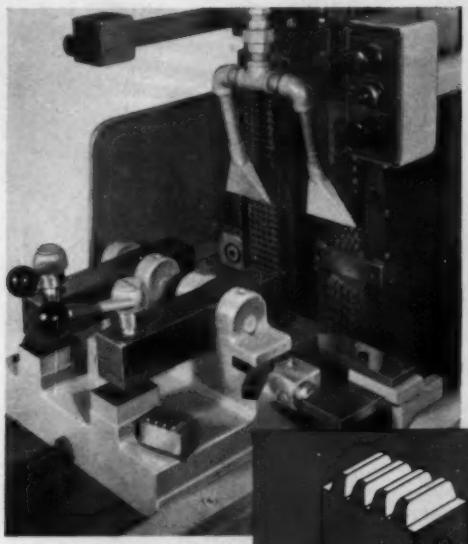
Surface broaching often can be one of the most economical of all machining operations. It's especially low in cost when performed on a completely equipped CINCINNATI, because two major factors are combined: the finest built machine and modern, practical tooling.

Consider the machine for a moment. CINCINNATI Broaching Machines have the latest and smoothest type of drive; hydraulic for the verticals, electro-mechanical for the horizontals . . . power range unlimited (a recent machine is rated at 600 hp) . . . modern safety features, such as Pre-Set Cycle Control, protect the machine and operator. And, for high-quality, low-cost production, tooling is the envy of the metalworking industry. Cincinnati Broaching Specialists have tooled up many jobs considered impractical by others.

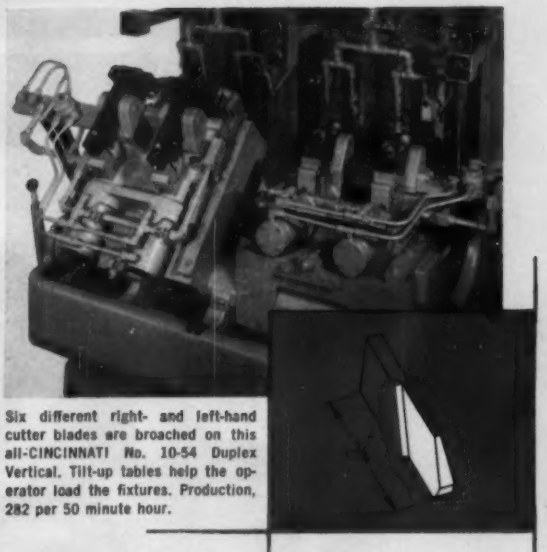
Examples shown here indicate the variety of parts being broached at the lowest possible cost on Cincinnati equipment. Give Cincinnati an opportunity to show you how surface broaching can reduce *your* manufacturing costs. Write today for literature, and ask for an Engineering Service appraisal of your surface broaching possibilities.



Electro-mechanical drive powers the ram of this Horizontal Hydro-Broach at speeds up to 150 feet per min. Port faces on V-8 engine manifolds are broached at the rate of 140 per 50 minute hour.



Coarse pitch rack teeth, requiring 7/16" total depth of cut, are broached in two operations on a No. 10-66 Single Ram Machine. Production, 100 per 50 min. hour.



Six different right- and left-hand cutter blades are broached on this all-CINCINNATI No. 10-54 Duplex Vertical. Tilt-up tables help the operator load the fixtures. Production, 282 per 50 minute hour.

MACHINES • COMPLETELY AUTOMATED PRODUCTION LINES

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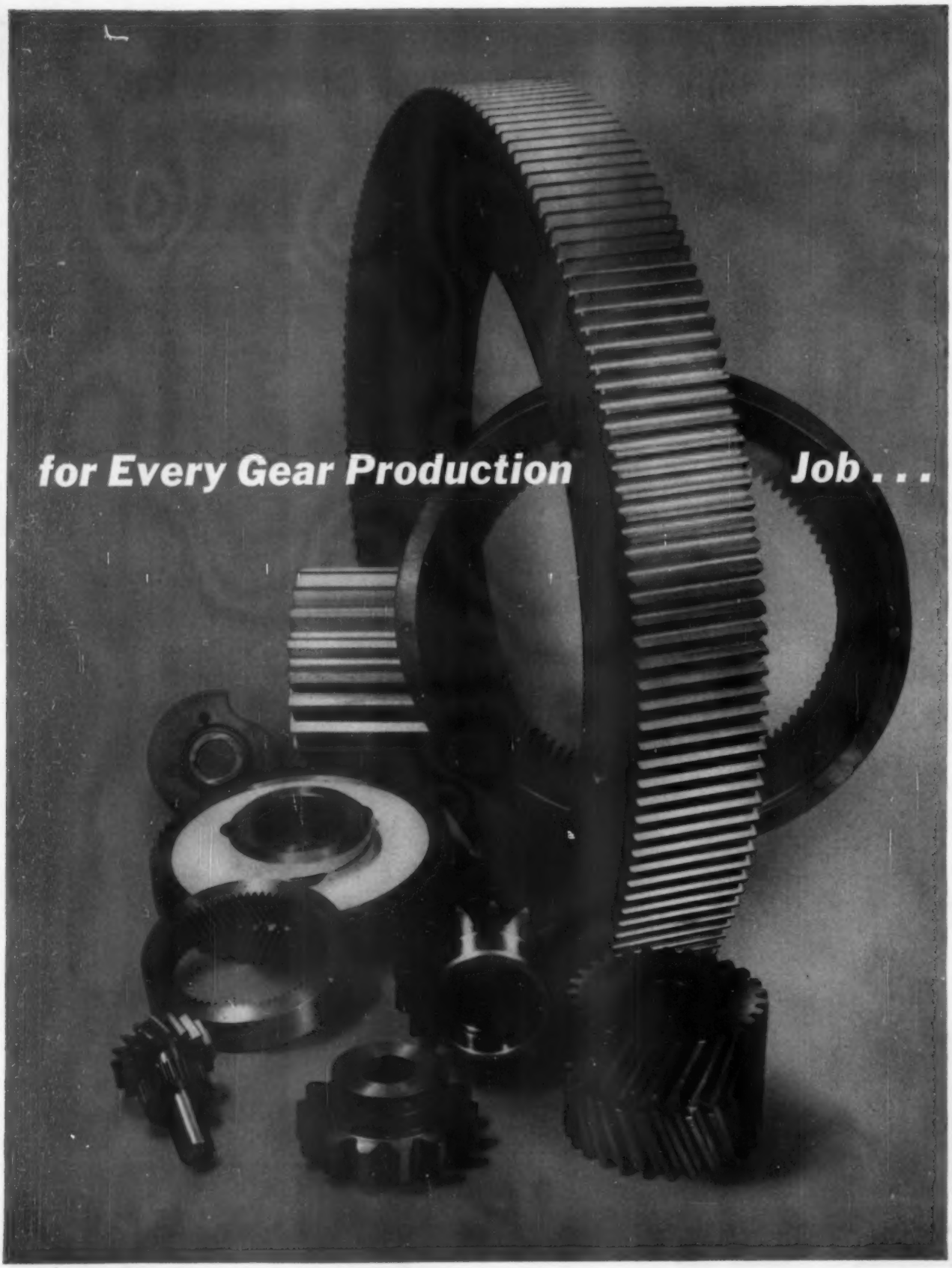
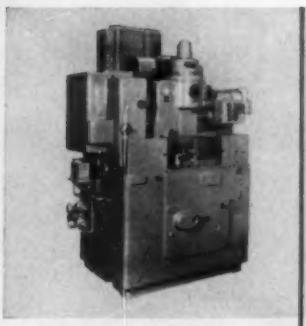

for Every Gear Production Job . . .

Right from the blank to the finished external or internal spur or helical gear, Fellows has the complete line of gear production and inspection equipment to meet all your requirements!

No other builder in the world offers as long and varied a line: Fellows Gear Shapers; Pfauter Gear Hobbers; Fellows-Reishauer Gear Grinding Machines; Fellows Gear Inspection Instruments; Fellows special machines and attachments; Fellows Gear Shaper Cutters. All this, *plus* the benefit of our sixty years of specialized experience in solving gear production problems.

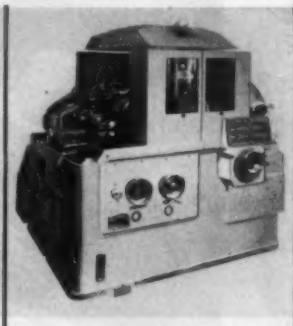
Ask your Fellows representative for information on the complete line of Fellows gear production and inspection equipment. If you have a problem requiring special equipment, ask him to help you solve it, or write direct.

. . . . Fellows Has the Equipment to Shape, Hob, Grind and Inspect

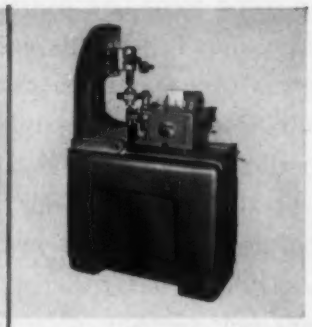


Fellows Gear Shapers cut internal and external spurs and helicals; capacities to 120″ P.D.

Pfauter Gear Hobbing Machines for spur and helical gears; capacities to 120″ P.D.



No. 12 Fellows-Reishauer Gear Grinding Machines grind spurs and helicals to 12″ O.D.



No. 20M Fellows Red Liners make and record the "composite check" of spur and helical gears to 18″ P.D.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont

Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE *Fellows Gear Production Equipment*

this man is looking for "BUGS"

The "bugs" in this case are possible flaws in thread rolling dies. The inspector will reject the rolls if he finds any that are not perfect. All of our products must pass a comparable examination before being sold. As a result, our customers are assured of quality products producing excellent results.

For example, one of our customers reported they had thread rolled over 30 million screws with a LANROLL Thread Rolling Attachment and the Attachment was still doing a faultless job. Other customers report similar results.

Inspection is but one phase in our overall operation designed as a concentrated effort to produce quality threading machines and tools whether it be for Cutting, Rolling, Tapping or Grinding. Research and engineering develop the design which will meet the rigid standards of efficient threading. In production, the proper metals are selected to achieve the results specified in the design. Finally, the inspection, as in our illustration, insures that the products are perfect.

Perhaps your threading operations could use the benefits of our concentration on threading?

MMT-PE

BOOTH NO. 432

LANDIS *Machine* COMPANY WAYNESBORO • PENNSYLVANIA • U. S. A.
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

Threading Machines

Taps—Collapsible & Solid Adjustable

Centerless Thread Grinding Machines

Thread Rolling Machines

Die Heads—Rotary & Stationary

Thread Rolling Tools

577C

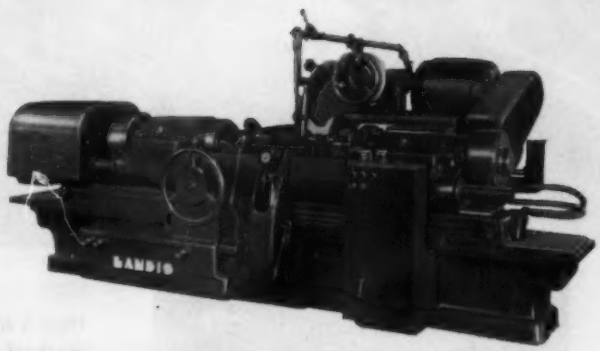
LANDIS micro

feed

gives uniform size, roundness and finish for *more* usable work pieces

MICROFEED is the new Landis precision wheel feed for large or small lot *production* grinding. On a new Landis grinder you can have this development that assures grinding precision to your closest tolerances. MICROFEED is an extra fine feed to final size that automatically cancels machine temperature variations, wheel wear, wheel pressure changes, and work variations.

Operation of MICROFEED is not complicated. It saves setup time, raises output by eliminating scrap due to feed variations.



MMTPE

LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

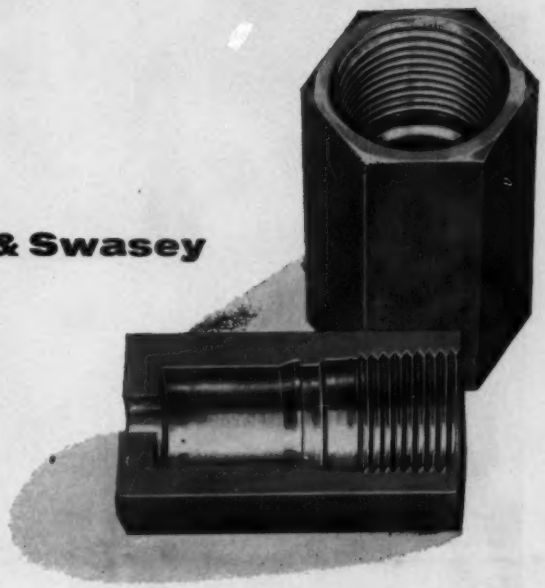
Here's how the new No. 4 permitted an improved machining method on the "bottom checks"... B-I-F's older machines had hand-operated collet chucks and bar feeds which required a turret station for a stock stop. In addition to the stock stop, six additional turret faces were required for the tooling, but only five stations were open. This meant that a quick change holder had to be placed on one turret face. For each part produced, a manual exchange of tooling had to be made in this one turret station. This was not only a fatiguing operation, but occasionally confused the operator as to which tool was in place, resulting in an occasionally scrapped part.

However, longitudinal feeding accuracy of the No. 4's hydraulic bar feed eliminated the need for a hex turret stock stop and thus opened up one more face on the turret—eliminated the hand exchange of tooling.

CIRCLE 163 READER SERVICE CARD

At B-I-F INDUSTRIES, INC.

Providence, Rhode Island



Modernization with Warner & Swasey No. 4 Turret Lathe saves FOUR minutes per piece on this "Bottom Check"

In this case, the new machine permitted an improved tooling method which combined to reduce first operation machining time from 10 to 6 minutes!

At B-I-F INDUSTRIES a wide variety of jobs are machined in lot sizes varying from 50 to 200 pieces—some special runs require only 3 or 4 pieces. Materials machined cover an equally broad range—from free-machining brass to various grades of stainless, Monel and Hastelloy.

B-I-F made a 31-week study of the new No. 4 versus their older No. 4's. The result showed substantial production increases on all types of machining jobs.

Machine features helping to effect these production time and cost savings include:

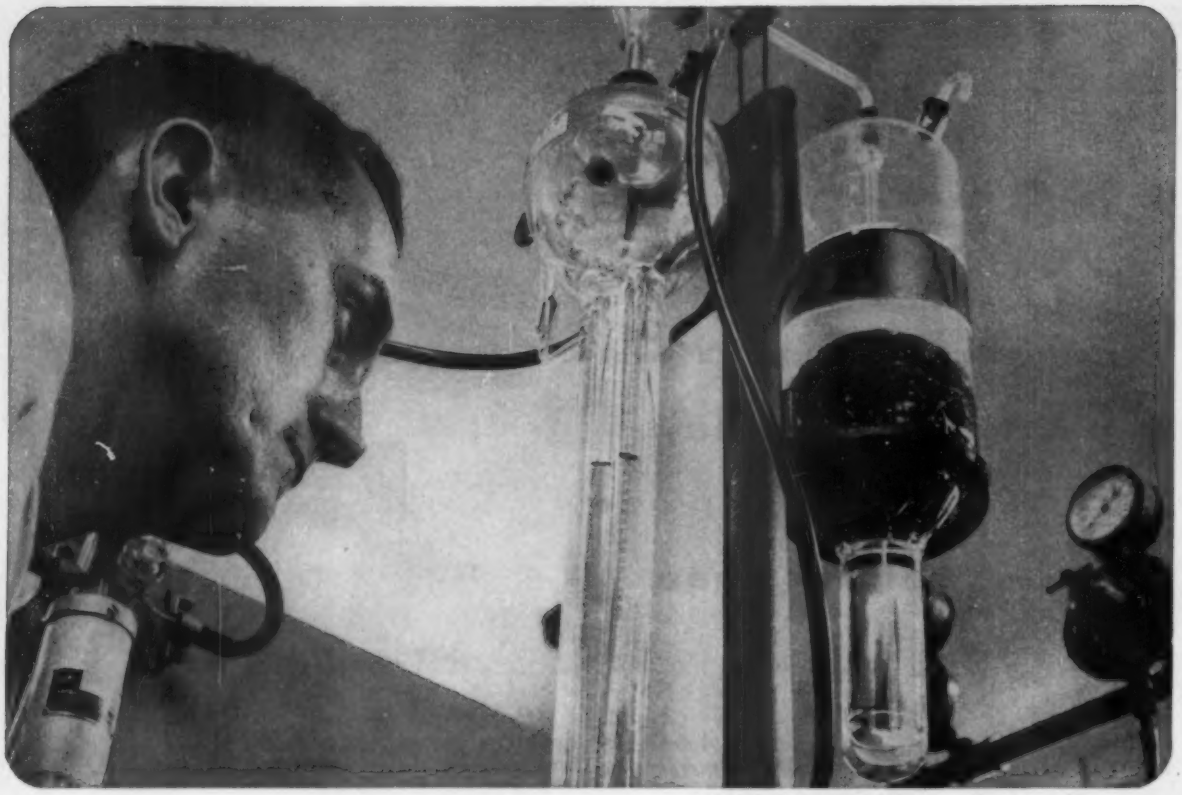
- **Handling ease of the machine—each model Warner & Swasey is individually designed for a specific range of work.**
- **Ease and simplicity of speed preselection and engagement—new all-clutch headstock design encourages use of the correct speed for every cut.**
- **Ability of the No. 4 to hold tolerances from .0005 to .001-inch total—helped eliminate subsequent finishing operations.**
- **Vibration-free running of constant mesh gear train headstock—substantially improved cutter life, permitted 32 to 63 micro-inch surface finishes to be easily held.**

Check today with your Warner & Swasey Field Representative and see how these versatile No. 4 Ram Type Turret Lathes can fit into your production picture—increasing production, boosting profits.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



QUICK, FAST TESTING for carbon content is done not once or twice but 8 times per melt in A-L's Chem Lab with this direct reading Leco carbon determinator.

Carbon content checked 8 times during melt to guarantee A-L tool steel hardenability

Lab tests for carbon eliminate your guesswork; provide high hardness, uniform hardenability, reproducible tool performance.

Because carbon has the greatest influence on hardenability, Allegheny Ludlum watches it carefully during the melt. Testing a specimen for carbon takes only a few minutes. Therefore, A-L checks for carbon content 8 times during the melt, and makes the necessary adjustments to insure accurate control of carbon. This control means Allegheny Ludlum can hold carbon content to a closer range than most customers specify.

Carbon control at Allegheny Ludlum assures you of precise response to heat treating. This control in the melt brings you predictable, *high hardness, uniform hardenability* and *reproducible tool performance.*

This is just one of the many things A-L does to insure high quality. Here are some others: close control over forging techniques, rigid temperature-time programming, careful testing of billets prior to processing to insure good surface and sound interior, control over annealing to give you the right hardness for your exact machining operation, thorough metallurgical testing to insure top tool steel quality and meeting of your specifications.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh 22, Pa. Address Dept. AM-5.

9281

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

Bearing manufacturer grinds large and small parts with new Gardner Disc Grinder

grinds **TWO** parallel surfaces in **ONE** operation

3 station rotary carrier with face cutting cycle

Continuously rotating carrier for small parts

2H30 Double Spindle Precision Disc Grinder

production data:	Races	Rollers
Size of workpiece.....	.504" Thick 6.508" O.D. 6.093" I.D.	1.25" long x 1.126" dia.
Production Rate: pieces per hour	100	600
Stock Removal: max. over-all	.010"-.012" per cut	.008"-.010"
Tolerances:		
Flatness and parallelism....	.0002"	.0002"
Uniformity.....	.00015"	.001"
Squareness TIR.....	—	.0002"

... User reports continue to stress performance value of 2H30 ... interchangeable work carriers permit quick change from job to job.

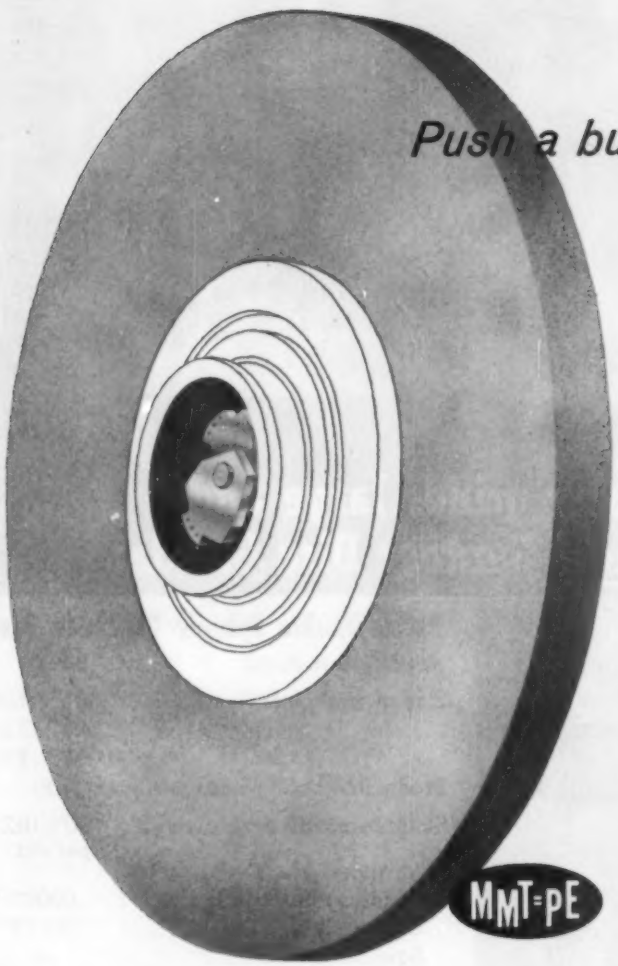
GARDNER

precision disc grinders

BELOIT, WISCONSIN

A. Unbalance. Badly out of balance wheel is shown in grinding position on the NORTON Balancer. Pendulum weights are locked in balance correcting position for wheel previously in use. Heavy spot, shown by yellow area, tends to displace center line of wheel spindle from normal center of rotation.

Push a button to balance

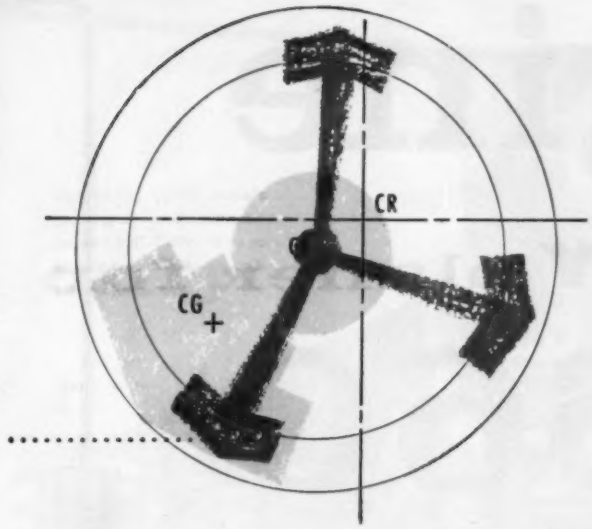


B. The Button Is Pushed. Wheel adapter assembly moves to soft spring suspension. Assembly tries to rotate about center of gravity. Centrifugal force acting outwards from center of rotation causes pendulum weights to move away from heavy spot, as shown.

C. Balanced in 5 Seconds. Pendulum weights have moved to the correct balancing position opposite the heavy spot. Center of gravity, center line and center of rotation are now common as shown. Weights lock and wheel adapter assembly returns to grinding position.

Unusual simplicity of the new NORTON Automatic Wheel Balancer introduces new advantages to unusual grinding operations. The wheel spindle and bearings are never released from carefully fitted housing. Balancing action is developed by slight release of only the wheel assembly from nose of spindle, permitting the assembly to be carried while balancing on a floating spring shaft. Three pendulum type balancing weights give maximum sensitivity to positioning forces. Wheel assembly and balancing weights are clamped and released automatically. Loosening a single spanner nut enables quick wheel changes. Safety interlock prevents operation of mechanism during grinding.

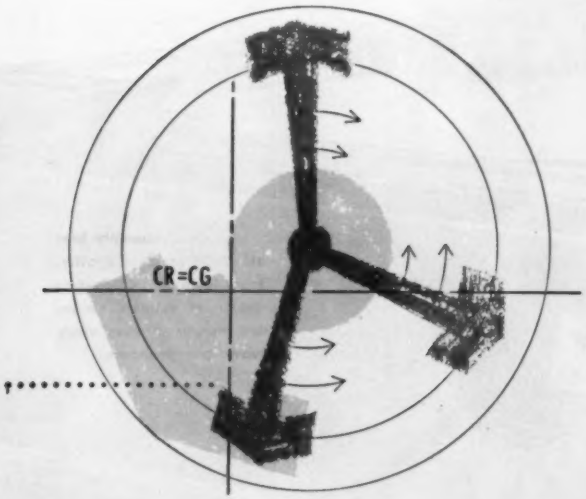
NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEAR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

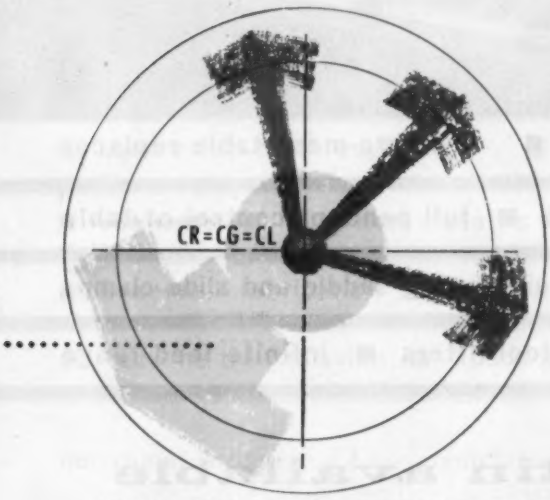


CG = Center of Gravity
CL = Center line of Wheel Spindle
CR = Normal center of Rotation

grinding wheels precisely . . .

automatically in 5 seconds





New and optional, the NORTON Automatic Wheel Balancer simplifies an extra operation for extreme precision grinding.

Engineered for ruggedness and high precision, NORTON cylindrical grinders have long been recognized for producing completely satisfactory results without wheel balancing — on or off the machine.

That holds good for all but a very small minority of grinding jobs calling for the absolute extreme in precision grinding. It is for such special requirements that the NORTON Automatic Wheel Balancer is designed.

That is why it is optional on most NORTON cylindrical grinders — and that is how it teams up to produce more positive precision than has ever been obtainable with previous wheel balancing methods.

Read the diagrammed descriptions shown here. See how simply, surely and swiftly the NORTON Automatic Wheel Balancer brings new advantages to wheel balancing for maximum precision grinding. For further details, see your Norton man, a Trained Grinding Engineer. Or write to NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. *District Offices:* Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

NORTON
MACHINE TOOLS

75 years of . . . Making better products . . .
to make your products better

MACHINE TOOL DIVISION: Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines • Gear Induction Hardeners

CIRCLE 168 READER SERVICE CARD

CIRCLE 169 READER SERVICE CARD ▶

imagine

buying a GRAY planer for

$30,660

above basic price includes 30" x 6' planer, one rail head, electric drive and controls

- available with single or double-cutting heads
- synchro-mesh table replacer
- new Gray knee
- knee and rail counterbalance
- full pendant control of table
- Gray Safety nut
- full floating drive shaft
- quick acting saddle and slide clamps
- abutment tool aprons
- non-shock pneumatic tool lifters
- infinite feed range

technical bulletin available

the new 30"-36"-42" flying scot

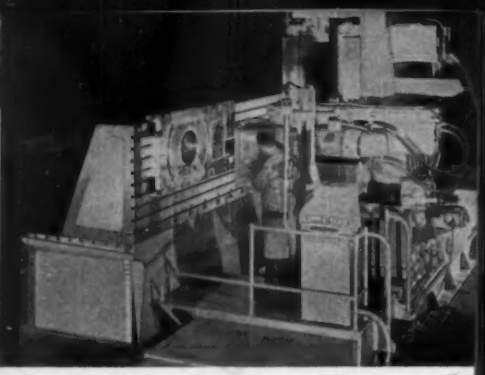
- square locked throughout
- flush bottom bed
- pyramid side walls on bed
- vee ways
- gray non-metallic ways—optional
- maximum capacity—table width
- 'reservoil' lubrication
- high table speeds
- duplex tables optional
- new column
- helicone transmission
- space saver drive
- table safety stop
- forced lubrication

horizontal milling and boring machines
planers
milling planers

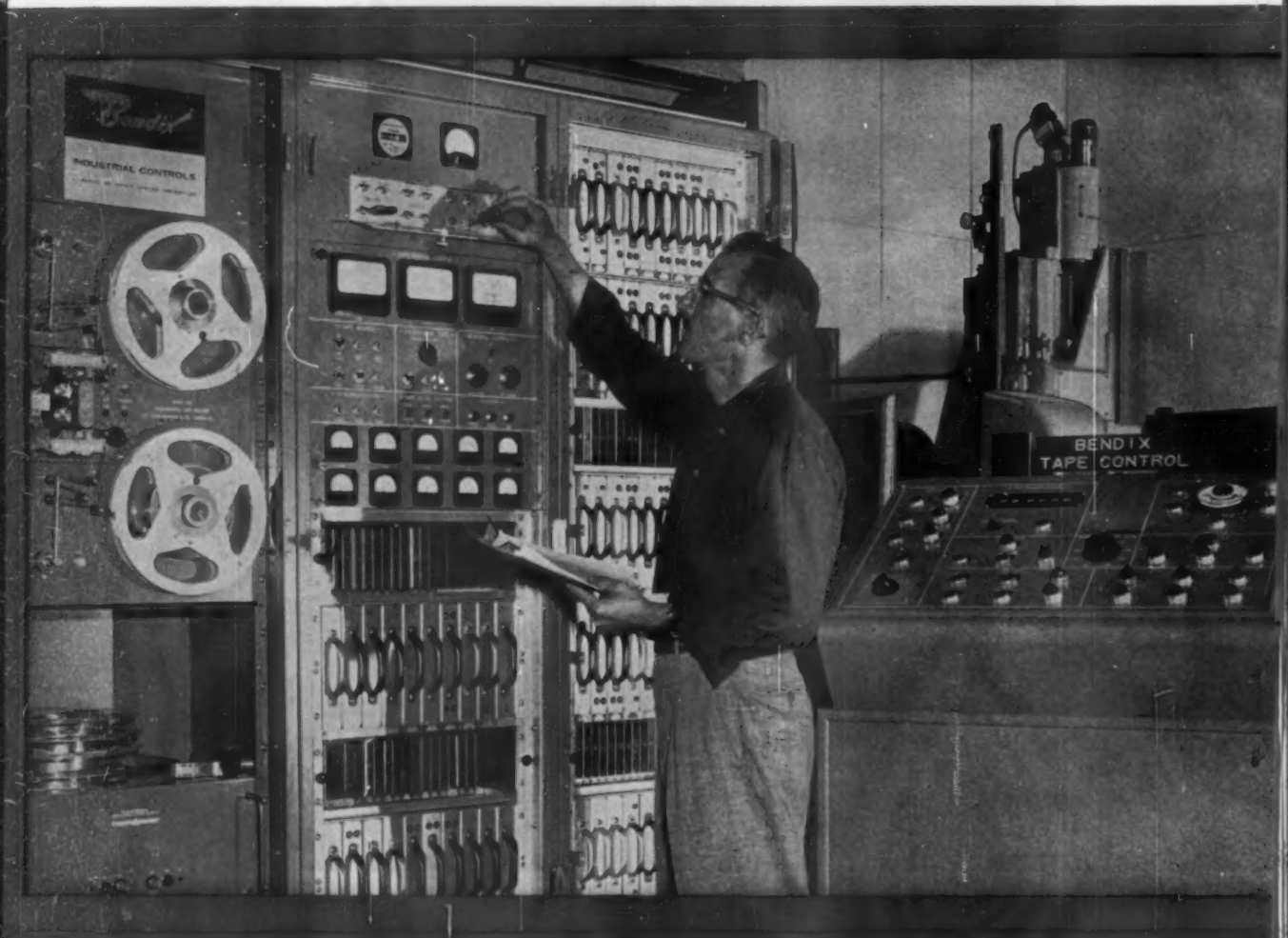
THE G. A. GRAY CO.
CINCINNATI, OHIO

1 Bullard vertical turret lathe similar to machine now being equipped with numerical controls for use by A.E.C.

2 Kearney & Trecker 3-axis milling machine in use at The Martin Co., Baltimore Division.



3 Kearney & Trecker 3-axis A.M.C. profiler in use at Norair Div. of Northrop Corp.

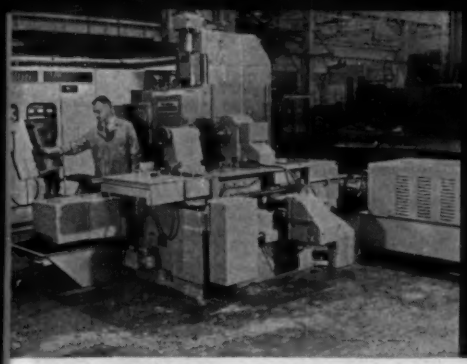


Bendix Continuous Path Machine Control Unit.

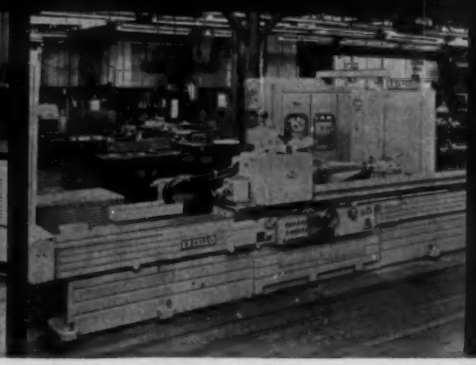
7 Kearney & Trecker 4-axis profiler in use at Columbus Div. of North American Aviation, Inc.

BETTER TOOLS THROUGH TEAMWORK

CIRCLE 171 READER SERVICE CARD



4 Pratt & Whitney 3 out of 4-axis Numeric-Keller in use at Pratt & Whitney Aircraft Div. of United Aircraft.



5 Ex-Cell-O rotary profiling machine in use at Ex-Cell-O Corp., Detroit.

6 Pratt & Whitney 3-axis Numeric-Keller in use at Pratt & Whitney Co.

TEAM REPORT: Bendix Numerical Controls for Machine Tools

MACHINE TOOLS WITH BENDIX NUMERICAL CONTROLS ROLL UP 190,000 PRODUCTION HOURS

Machine Tool Builders, Bendix, and Machine Tool Users Team Up To Cut Production Costs and Lead Time With Numerical Controls.

Bendix Continuous Path Numerical Controls have logged more than 190,000 hours (95 work years) of production time on a wide variety of machine tools. The photos and captions on these two pages show a few of the applications of Bendix Numerical Control on machine tools.

Bendix considers numerical control a *Complete* Manufacturing Concept and offers the user and machine tool builder experience in Electronic Data Processing, Electronic Controls and Machine Tool Servo Design. This concept achieves practical reality through the cooperation and teamwork of the machine tool builder, Bendix, and the machine tool user. And Bendix has more working experience in the field of continuous path control with machine tool builders and major users than any other electronic controls manufacturer.

Bendix teamwork experience gives the manufacturer who needs machine tools a marked benefit: it permits him to plan ahead *now* by specifying Bendix Numerical Controls for his machine tools. Regardless of product configuration or machine tool preference, Bendix can deliver numerical controls that have been proved in use.

Watch for announcement soon on positioning controls by Bendix.

Industrial Controls Section

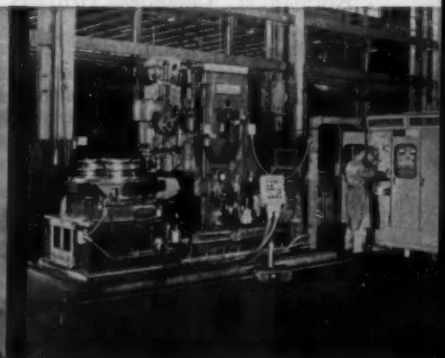
21820 Wyoming, Detroit 37, Michigan

Bendix
AVIATION CORPORATION

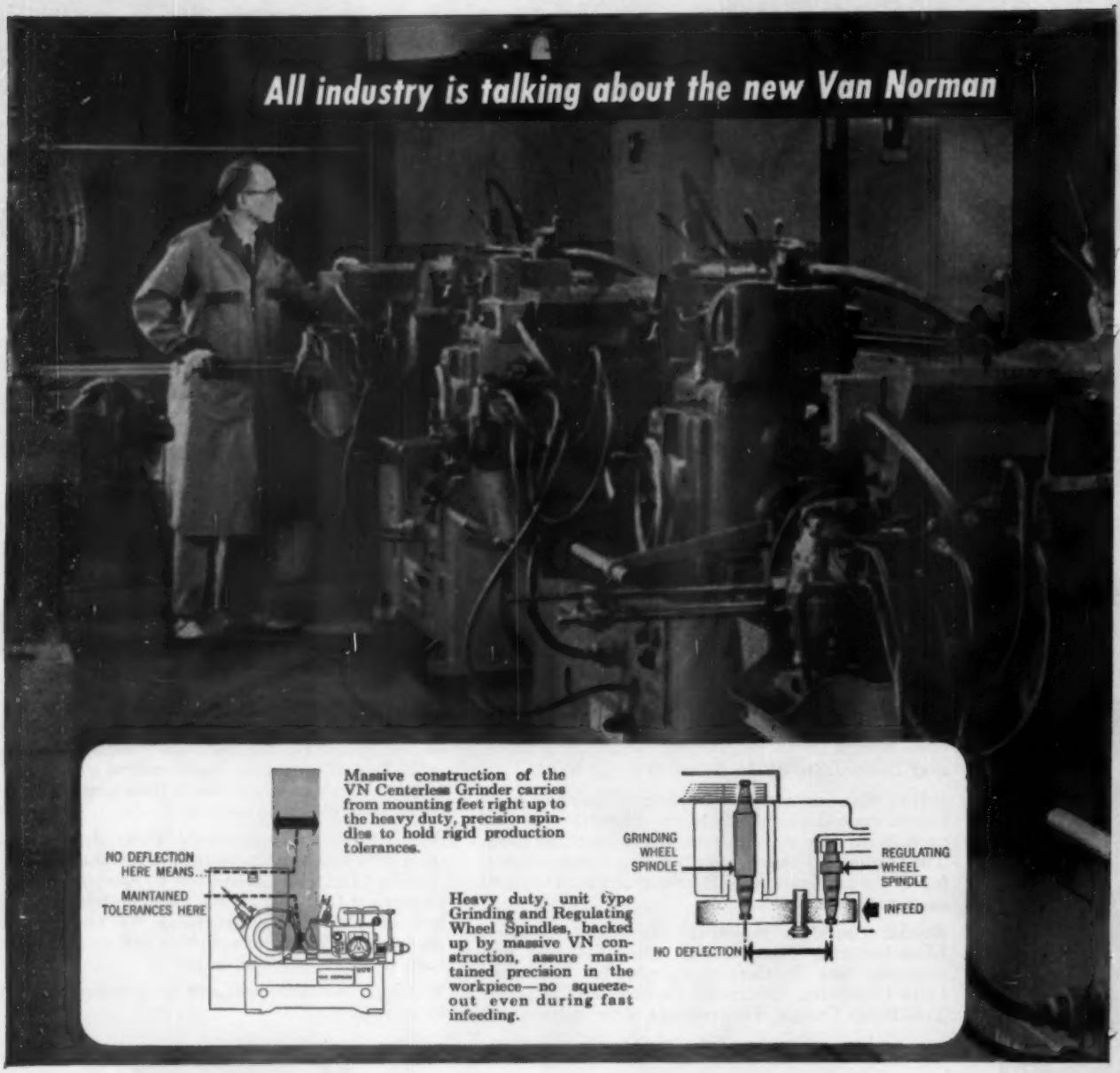
8 Ex-Cell-O cam milling machine in use at Hamilton-Standard Div. of United Aircraft Corp.

9 Ex-Cell-O Model 922 precision template grinding machine in use at ACF Industries.

10 Kearney & Trecker 2-axis rotary profiler in use a Pratt & Whitney Aircraft Div. of United Aircraft Corp



All industry is talking about the new Van Norman



Massive construction of the VN Centerless Grinder carries from mounting feet right up to the heavy duty, precision spindles to hold rigid production tolerances.

Heavy duty, unit type Grinding and Regulating Wheel Spindles, backed up by massive VN construction, assure maintained precision in the workpiece—no squeeze-out even during fast infeeding.

NEW VAN NORMAN GRINDER TRIPLES

VN 2C Centerless Grinders turn out famous cutting tools with spectacular speed,

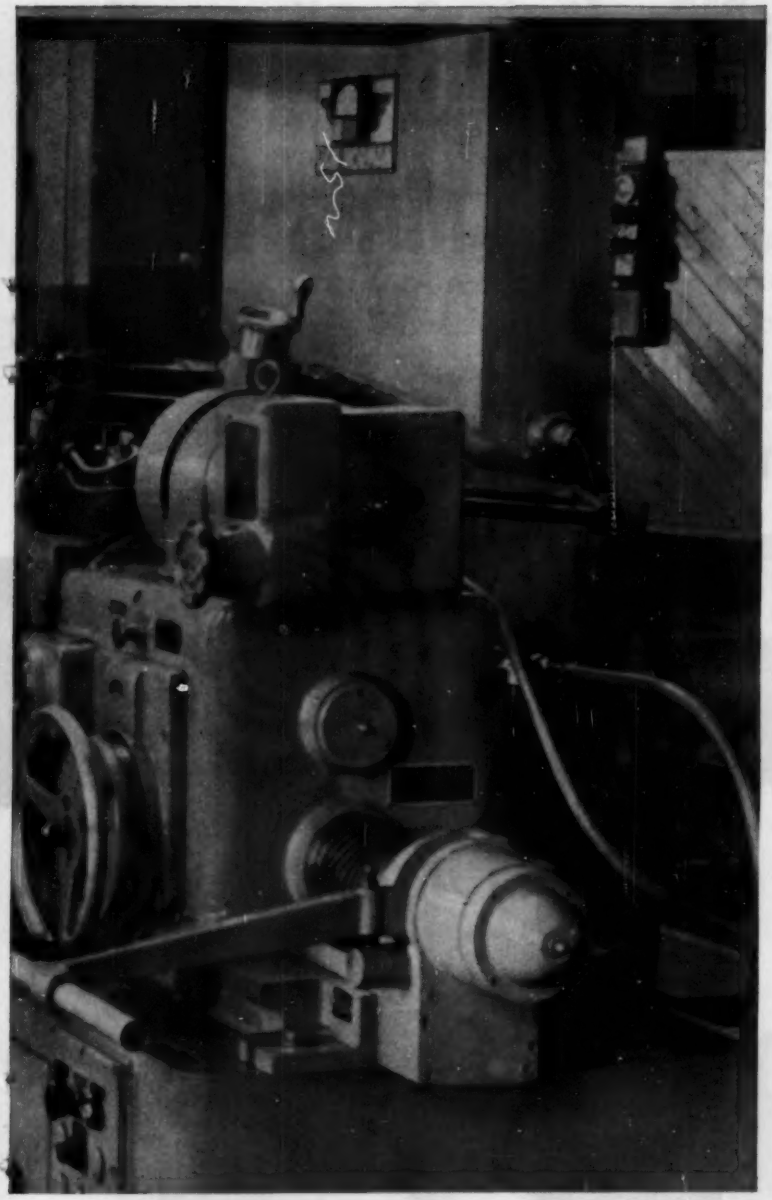
Production rates at Morse Twist Drill and Machine Co., in New Bedford, Mass., boomed when new Van Norman 2C Centerless Grinders were put to work. One of these rugged, heavy-duty machines actually combines the output of *three* centerless grinders! What's more—one man at Morse can set up and operate three VN 2C's *simultaneously* to turn out 5,000 precision-ground drills an hour. Previous box score: one man; one machine; only 800 drills an hour.

300% Faster Output To Close Tolerances—Work speed is hand-wheel regulated, gives an infinite RPM range to regulating wheel drive. The grinding wheel—large 24 x 8 x 12 inches—is profile diamond dressed, and increases machine efficiency by producing more pieces per dressing. Special tooling provides automatic operation for grinding with hopper feeding, and a unique unloading method. Traditional Morse quality is maintained by holding tolerances of 0.00025.

VAN NORMAN

SPRINGFIELD 7, MASSACHUSETTS

8381



PRODUCTION AT MORSE

versatility, precision, economy

On Any Job, More Work Per Operator Per Work Shift — with the fast, versatile, accurate, cost-cutting VN 2C Centerless Grinder. Thru-feed or infeed. Capacity 0" to 4¾" diameter. Van Norman unit-type, anti-friction bearing spindles on both grinding and regulating wheels. Optional: VN Crush Dressing Attachment.

Free Booklet—"Centerless Grinding"—valuable guide to high production, lower costs. For your copy, contact factory or your local distributor.

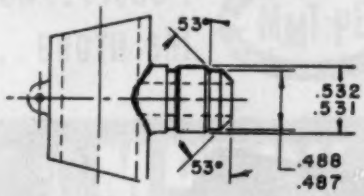
MACHINE COMPANY

A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

VN

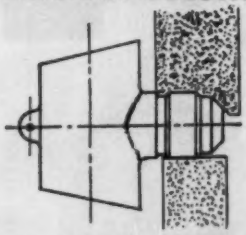
Another typical Van Norman centerless grinder cost-saving application

CUSTOMER'S PROBLEM:



To produce parts to print at lowest possible cost. Van Norman was asked to suggest method of grinding .487/.488 diameter, .531/.532 thread diameter and 53° seal angle. These dimensions had previously been turned on screw machine without good results. Particularly the 53° angles which required that a 90% blue must be had when checked in a master gauge. Chatter and runout were the two major problems by the previous method.

VAN NORMAN SOLUTION:

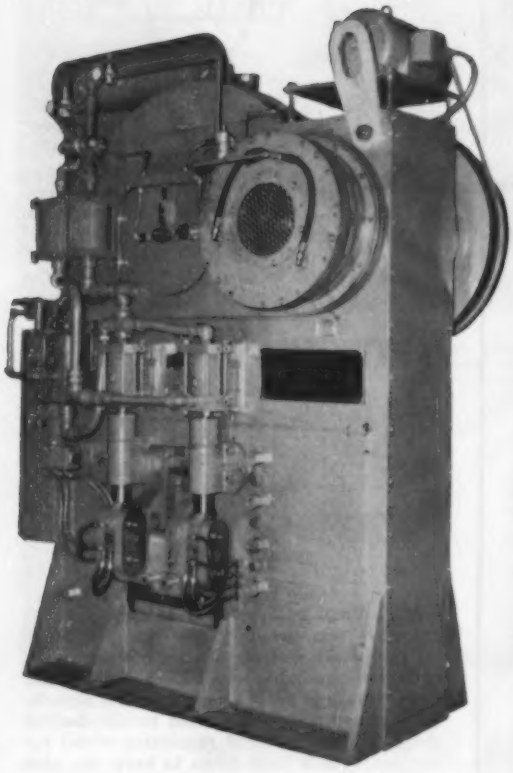


Using a VAN NORMAN Centerless Grinder, the part was ground. The part was first rough turned and formed to a straight diameter of approximately .535 and a 53° angle. Then, by using a VN Crush Forming Attachment, the wheel was formed to the desired shape, using a straight regulating wheel for support, plus a hold down to keep the part from tipping off the blade. The part was ground in one operation to desired size and finish.

THE RESULT:

Operation was entirely successful. Several VN machines are now in operation on this job. Reports show the customer is producing parts at the rate of 240 pieces per hour at 100% efficiency, and are grinding up to 1500 parts per wheel dress. This is another typical cost-saving advantage of Van Norman Crush Forming.

BILLET SHEARS

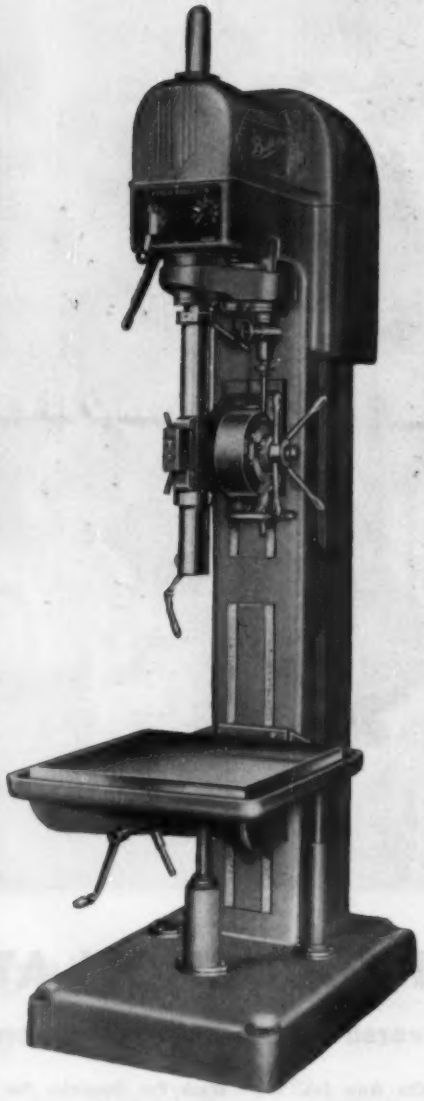


PRODUCTION CUTTING OF BILLETS — the "400" Billet Shear introduces advanced features. It will function at full capacity (within its rating) on any shearable material . . . Up to 4" square or 4½" round . . . Operates at speeds up to 60 strokes per minute! Makes clean, square cuts. May be automated for a potential of as many as 18,000 cuts in an 8-hour shift. Rigid alloy steel frame, electrical controls, air-operated automatic oiling system.

SHEAR
DRILL
BEND
PUNCH
COPE
NOTCH
SLIT
for
Production
or
Maintenance

ESTABLISHED 1877 "Buffalo" NUMBER NINETEEN

DRILLING MACHINES



DRILLS "IMPOSSIBLE" JOBS — the matchless "RPMster" with instant fingertip speed control, all-geared power feed, nickel steel ball bearing back gears and full ball bearing alloy steel spindle. Available in 1", 1½" and 2" drill capacities. New **hollow spindle** permits use of advanced type bits in drilling exotic metals and other "impossible" jobs.

Sharpen Your Production Efficiency . . .

Look at your obsolete, worn out equipment. Consider your loss in unit production, poor work quality. You can change this loss to a profit with modern *Buffalo* Machine Tools. Quality Built for years of extra production life, *Buffalo* Machine Tools are being used in every industry for production and plant maintenance. Look them over, there is probably a model that should be in your plant right now.

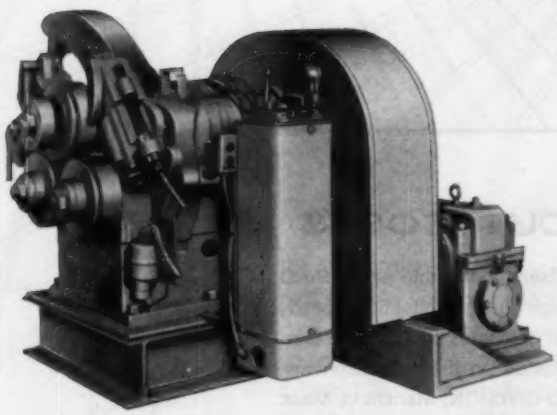
GOING TO THE MACHINE TOOL EXPOSITION . . . 1960 ?
SEE THESE BUFFALO MACHINE TOOLS IN ACTION . . . BOOTH 551

MMT-PE

BUFFALO FORGE COMPANY
MACHINE TOOL DIVISION

509 Broadway, Buffalo, N. Y. • Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

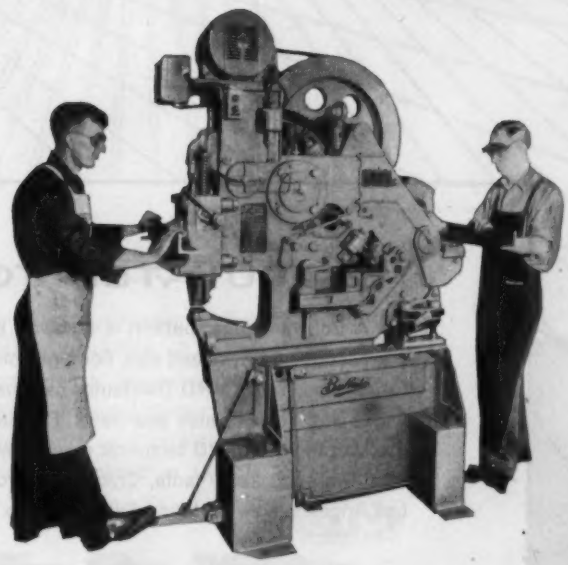
BENDING ROLLS



COLD METAL BENDING WITHOUT DIES — Buffalo Bending Rolls handle angles, rounds, squares, tubes, pipes, flats, special shapes. Turn out commercially accurate circles, arcs and spirals at production speed. Setup is fast due to easily changed standard or special rolls and easy radius adjustment. Precision-built, heavy-duty machines, quality engineered throughout. New, compact speed-reducer drive means important savings in floor space.

CIRCLE 176 READER SERVICE CARD

IRON WORKERS



SEVEN OPERATIONS — SAME MACHINE WITHOUT CHANGING TOOLS — the Buffalo Universal Iron Worker. A rugged, versatile "1-machine shop" that cuts, punches, shears, slits, notches and copes — saves valuable shop space, makes short work of your maintenance and production fabrication jobs.

CIRCLE 177 READER SERVICE CARD ▶

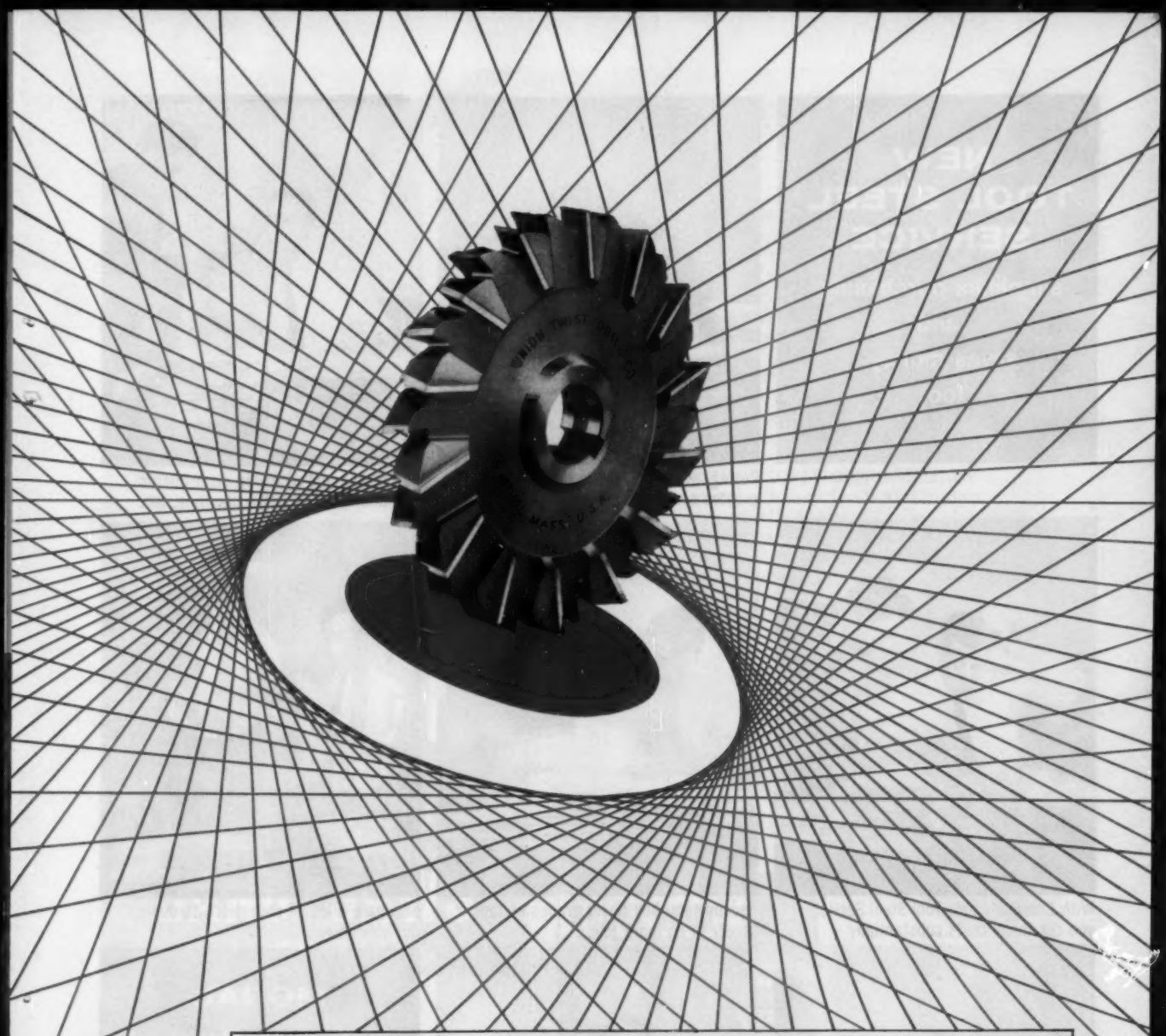
CALCULATED TO CUT COSTS

A truly geometric pattern is followed in precisely duplicating each CARD tap, according to type and size. For high volume, high quality production, specify CARD taps. Your CARD Distributor can make fast deliveries of the taps, dies, gages and screw plates you need. For helpful advice on their selection and use, call in your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Every UNION cutting tool is duplicated with geometric precision, in each type and size. To your own plant this exact duplication of UNION inserted blade cutters brings most dependable performance, longest service life. Make sure you get these advantages. Specify UNION inserted blade cutters, drills, reamers, milling cutters, end mills, gear cutters, hobs, and carbide tools. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

NEW TOOL STEEL SERVICE

simplifies purchasing (and saves money, too)

Buying assorted brands of tool steel creates costly paperwork for your . . .

purchasing and receiving departments — manufacturing and accounting, too.

With Crucible's new Tool Steel Service you cut these costs substantially

because you buy fewer grades of tool steels to do more jobs . . .

eliminate piles of paperwork throughout your plant . . .

carry fewer pounds in stock (reduce chances of inventory "mix-ups"), and...

pay a lower price per pound (by eliminating costs for small quantity "extras").

MORAL

You benefit with Crucible's new Tool Steel Service. For the full story, call in a Crucible Service Engineer.

CRUCIBLE STEEL COMPANY OF AMERICA

Branch Offices and Warehouses: Atlanta • Baltimore • Boston • Buffalo • Caldwell, N. J. • Charlotte • Chicago • Cincinnati • Cleveland • Columbus • Dallas • Dayton Denver • Detroit • Erie, Pa. • Grand Rapids • Houston • Indianapolis • Los Angeles • Miami • Milwaukee • Minneapolis • New Haven • New York • Philadelphia Pittsburgh • Portland, Ore. • Providence • Rockford • Salt Lake City • San Francisco • Seattle • Springfield, Mass. • St. Louis • E. Syracuse • Tampa • Toledo • Tulsa
CRUCIBLE STEEL OF CANADA, LTD., SOREL, QUEBEC, CANADA

◄ CIRCLE 178 READER SERVICE CARD

CIRCLE 179 READER SERVICE CARD

NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW!

The blades that outlast all others!

A RADICALLY NEW METALLURGICAL APPROACH builds unprecendented durability into Heller "Ultras". That's why they're certain to outlast all high speed steel band saws currently used in production cut-off work on ferrous metals. **IMPROVED IN EVERY WAY!** Special steel analysis . . . more advanced production methods . . . closer heat-treating control . . . stronger welds . . . more exacting 100% inspection! No wonder Heller "Ultras" deliver up to 300% more cuts per blade. Yet, the price is only 10% higher. This means as much as 75% savings in cutting costs.
TESTS CONFIRM THEIR SUPERIORITY! Matched against all comers, at heavy feeds and higher speeds, the harder teeth, tougher bodies and more uniform full-blade flexibility of Heller "Ultras" are sure bets to win the race against time and costs. Seeing's believing!

Heller

"ULTRA"
HIGH SPEED STEEL
metal cutting
BAND SAWS

INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PRODUCTION

TAKE THE GAMBLE OUT OF BUYING!

An early order for welded-to-length, protectively packaged Heller Ultra High Speed Steel Band Saws from your nearby Heller Distributor is the wisest and safest bet you'll ever make. Prompt delivery is also guaranteed!

17.0.17

HELLER TOOL CO.

America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.

Branch Offices and Warehouses: Boston • Newark, N. J. • Detroit • Chicago • Shreveport • Los Angeles • San Francisco • Portland, Oregon

ERICKSON

QUICK CHANGE HOLDERS

...for use with your standard MMS tapered tools ...designed for presetting of tools

Now you can use your present standard MMS tapered tools with the *new* Erickson Quick Change Holders. That means you get the double production advantage of Erickson's *high precision coupled with the rapid change feature.*

Several different models comprise the line: Morse taper holders for boring mills and radial drills, milling machine holders that fit standard spindle tapers, turret lathe holders that increase turret lathe tool-holding capacity, straight shank holders with #30 or #40 MMS socket. These holders take Erickson Collet Chuck milling machine adapters in both regular and heavy duty types, end mill adapters, shell and face mill adapters, Morse taper adapters, boring head adapters, and chuck adapters for Jacobs internal taper.

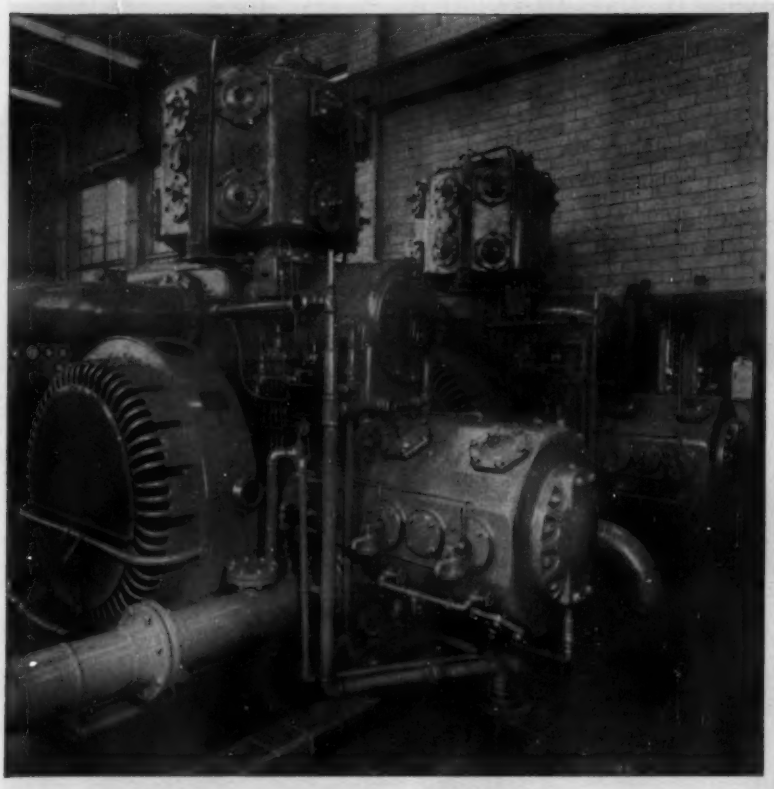
AA-7455

A call or card will bring the Erickson representative on the double. Meantime write for your copy of Catalog G "Erickson Quick Change Holders."

ERICKSON TOOL COMPANY

34559-5 SOLON ROAD • SOLON, OHIO

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES



IN I-R COMPRESSORS,

TIME TELLS

THE DIFFERENCE

In these two XLE compressors, 21 Channel Valves have operated

45,482 HOURS

with no parts replaced!

The two Ingersoll-Rand XLE air compressors shown above are installed at a large midwestern automotive plant. They were started up in May, 1951, and at this writing have totalled 45,482 hours, mostly at 16 to 24 hours a day.

Of the 28 Channel Valves (14 per unit), 21 have operated full time with *no repairs,* merely being cleaned once a year. Each of the other seven valves had only one channel and spring replaced in all this time, during the scheduled inspection period. And all the valves are operating with their seat plates still on the first side—when the plates are turned over, their life will be doubled.*

The *extra value* that's built into every type of Ingersoll-Rand compressor pays off with *long-run economy.* Reduced maintenance and attention, over many years, mean long-range savings in the cost of air power. Ask your I-R representative for more information on the world's most complete line of compressors, from 1/2 to 7500 hp. Call him now.

***Only I-R compressors have Channel Valves**
Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of rigid stainless-steel channels and bowed leaf springs, with trapped-air spaces which cushion action, prevent impact.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

111A1

The World's Most Comprehensive Compressor Experience

He's Watching a Band Sawing Miracle

This band saw operator at the Bell & Gossett Company plant in Morton Grove, Illinois, is watching "Controlled Accuracy". . . accuracy, being held to within a few thousandths of being perfectly straight, and he can actually *see* the band blade being guided in the saw cut to produce this accuracy! No further machining is required before the pipe is welded into an assembly for a Bell & Gossett Heat Exchanger Unit.

Band sawing accuracy like this is nothing short of miraculous—especially when it can be done on a high production basis, as Bell & Gossett is doing. And when the same tolerances can be held on cut-off pieces from 2" to 18" in diameter, this MARVEL #81 Band Saw Machine can be truly called a precision machine tool.

The secret of this amazing sawing accuracy is in the MARVEL "SURE-LINE" Automatic Accuracy Control—a simple and extremely effective electro-mechanical servo-mechanism that continuously senses and automatically corrects any tendency of a band blade to drift to either side of a desired line of cut. The "SURE-LINE" unit literally "steers" the blade to make a straight cut. This permits the use of heavier feed pressures and, when desirable, higher blade speeds, to do the work faster, without sacrifice of accuracy. Incorporated in the new MARVEL #81 Series High Speed Heavy Duty Hydraulic Band Saws, the "SURE-LINE" permits full utilization of all the advantages of high speed steel band saw blades—while extending their usable blade life as much as 50%.

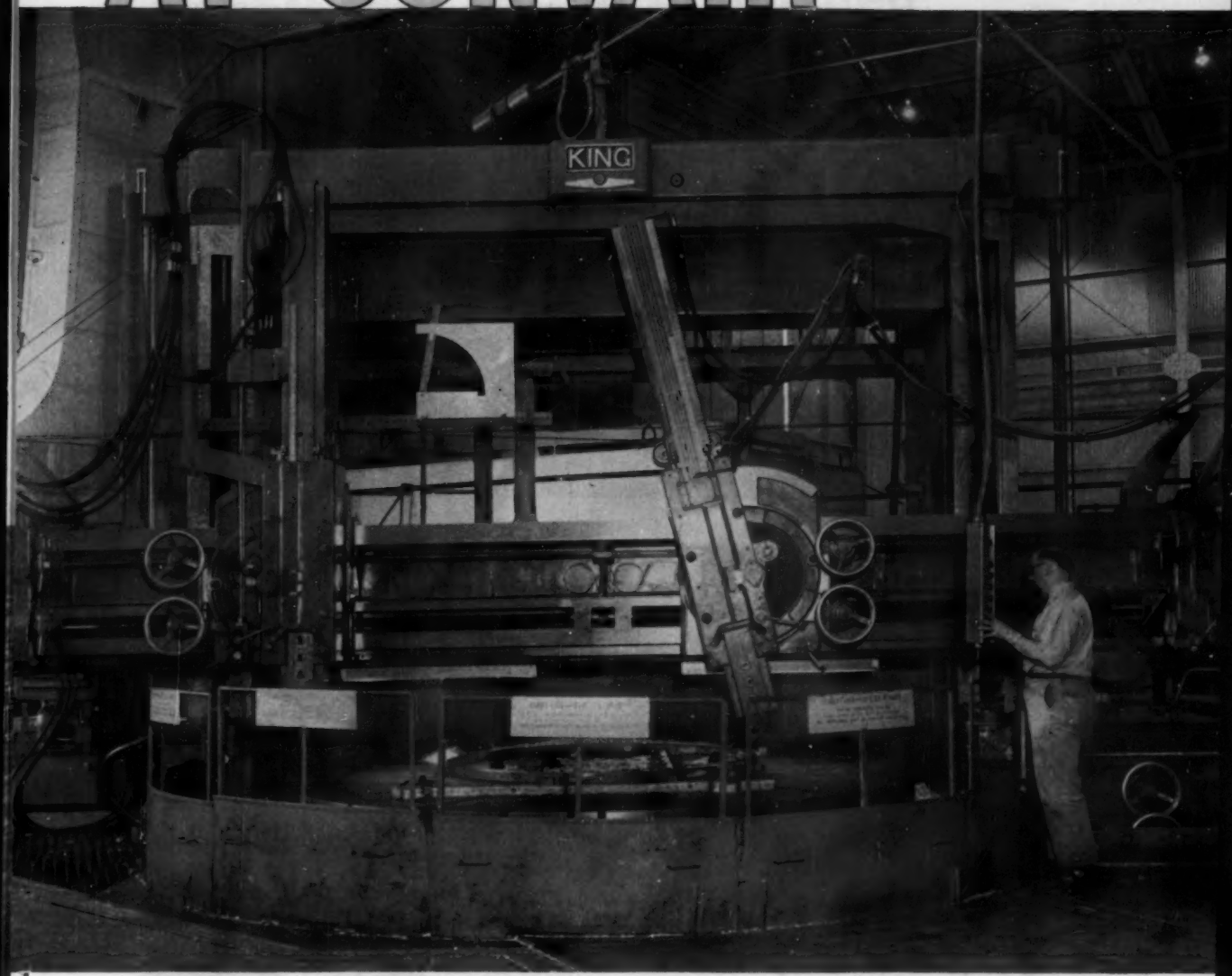
Before you buy any band saw machine, get complete details on MARVEL #81 Series Single Cut, or Automatic Shuttle Type Bar Feed Production Band Saws—the machines DESIGNED AND BUILT TO REDUCE SAWING COSTS. *Write for catalog today.*

MMT-PE

ARMSTRONG-BLUM MANUFACTURING CO.
5700 West Bloomingdale Avenue • Chicago 39, Illinois

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

AT CONVAIR — SAN DIEGO



Convair's Plant No. 1 Tooling Department uses this specially designed 168" KING® to shape drop hammer dies, plastic patterns used for production mock-ups, and plastic tools. They report, "Production of such tooling in sizes and tolerances required was not possible with previously available machines."

Versatility is just *one* virtue of this big "customized" KING

It's Fast, Accurate and Dependable, too!

KING *Vertical Boring and Turning Machines*

ELMES *Hydraulic Presses and Equipment*

American Steel Foundries / ELMES-KING Division, 1161 Tennessee Avenue, Cincinnati 29, Ohio

MACHINE TOOL EXPOSITION CHICAGO, Sept. 6-16

MMT-PE

CIRCLE 184 READER SERVICE CARD

ANNOUNCING A NEW OXIDATION RESISTANT

GRAPHITAR®

(CARBON-GRAPHITE)

FOR HIGH TEMPERATURE APPLICATIONS

Culminating five years of intensive research, engineers of The United States Graphite Company have developed a new oxidation resistant GRAPHITAR. In exhaustive tests, GRAPHITAR parts were exposed in an oxidizing atmosphere (air) at 1200 degrees F and after 200 hours, the GRAPHITAR showed a weight loss of less than six percent!

GRAPHITAR, which is available in many grades, is a versatile engineering material with unusual and outstanding properties that make it ideal for tough applications. It is non-metallic, resists chemical attack, has self-lubricating properties and a low coefficient of friction. It is mechanically strong, lighter than magnesium and is the perfect material for packing rings, pressure joint seals, clutch release bearings, fluid coupling seals, piston rings, pump liners and vanes.

For more information on this new oxidation resistant GRAPHITAR and its applications, write the GRAPHITAR product manager on your company letterhead.

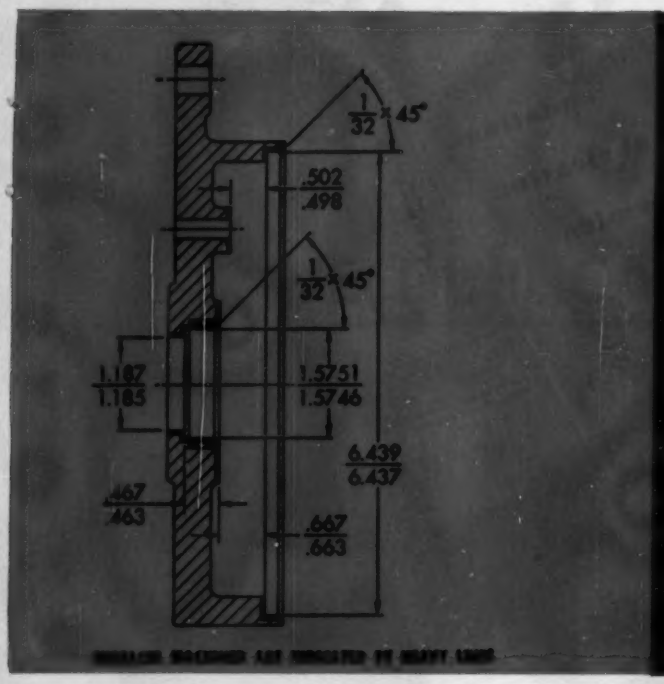
R-279-1

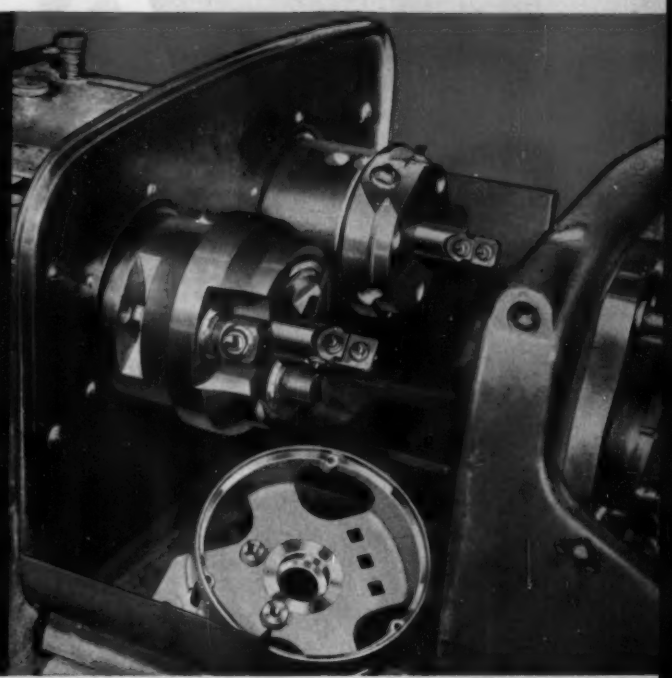
THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW 16, MICHIGAN

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® POWDER METALLURGY • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

9 surfaces rough and finish machined in 2 passes...





HOW MICROBORE CLUSTER TOOLING DOES IT ON A PRECISION BORING MACHINE!

Special Microbore Cluster Tooling makes it possible for a leading electrical equipment manufacturer to obtain a continuous flow of finished parts by rough and finish machining, simultaneously, nine surfaces on a generator end bell casting in two passes.

SET-UP TIME IS FASTER, TOO—Independent, precision adjustment of each tool point permits accurate settings in a matter of seconds. Speed and accuracy of adjustment, plus compactness of Microbore units, makes cluster tooling practical to a degree formerly considered impossible.

Microbore is a versatile tool with unlimited application for all types of boring, turning and facing operations. Microbore Standard Boring Bars, Boring Bar Sets and Flash-Change tooling complete the perfect combination for accurate, quick change tooling.

•To find out how Microbore can help you, write for our new catalog No. 58.

DeVlieg Microbore System

DEVLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

Fair Street • Royal Oak, Michigan

CIRCLE 186 READER SERVICE CARD

FORMICA SPECIFIES MORSE TOOLS

Morse Electrolized Tools proved best by test for tapping—drilling glass, fabric and paper—base materials.

Formica pulls no punches in its installation manual . . . they recommend Morse. Why? Because they proved Morse Electrolized Taps and Drills *best* by test for installing their material.

Prove to yourself what Formica and other manufacturers have found . . . the exclusive Morse *Electrolizing* Process gives up to 30% longer tool life on the toughest jobs – no matter what base materials are used, there is a Morse Tool designed to help you cut production costs . . . build a better product.

See your Morse-Franchised Distributor. He is the *only* man to see when you want the best in cutting tools. Call him *today*.

MORSE

means "THE MOST" *in Cutting Tools*

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS

Warehouses in: NEW YORK • CHICAGO • DETROIT • DALLAS • SAN FRANCISCO

Morse means more production . . . smoother, more accurate production . . . with every type of cutting tool from drills, reamers, taps and dies, to end mills, milling cutters, slitting saws and "specials". So, if you want the best from every cutting tool you buy, mark your order "MORSE". For if you want *Morse Quality*, there's only one way to get it . . . *specify Morse.*

VN

A Division of VAN NORMAN INDUSTRIES, INC.

CIRCLE 187 READER SERVICE CARD

2286

POSITIVE DUPLICATION—EVERY TIME!

One animal makes tracks like these, a pattern that is positively duplicated only by the grizzly bear. And only Cincinnati offers you the Positive Duplication of these INTERNAL WHEELS, and of *all* CINCINNATI (PD)° GRINDING WHEELS.

HOW WE ACHIEVE "PD"

To produce these grinding wheels of unsurpassed uniformity, Cincinnati developed a unique manufacturing process. It involves 36 separate quality controls, from formula blend to final inspection. For example, cams for temperature control of drying ovens must pass regular tests for accuracy, and checking procedures never vary.

HOW UNIFORMITY HELPS YOU

One big advantage of CINCINNATI (PD) WHEELS is—longer wheel life. Cut the need for frequent wheel changes, and you boost production. Using (PD) WHEELS you can plan production schedules with the assurance that each reorder wheel will act and grind exactly like the original. This is the promise—and *performance*—of Positive Duplication.

CUT COSTS . . . CALL CINCINNATI

You can solve your grinding problems with the help of Cincinnati's factory-trained specialists. Their wide experience in job set-ups and grinding operations is at your service. Just call your CINCINNATI (PD) GRINDING WHEEL Distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI GRINDING WHEELS

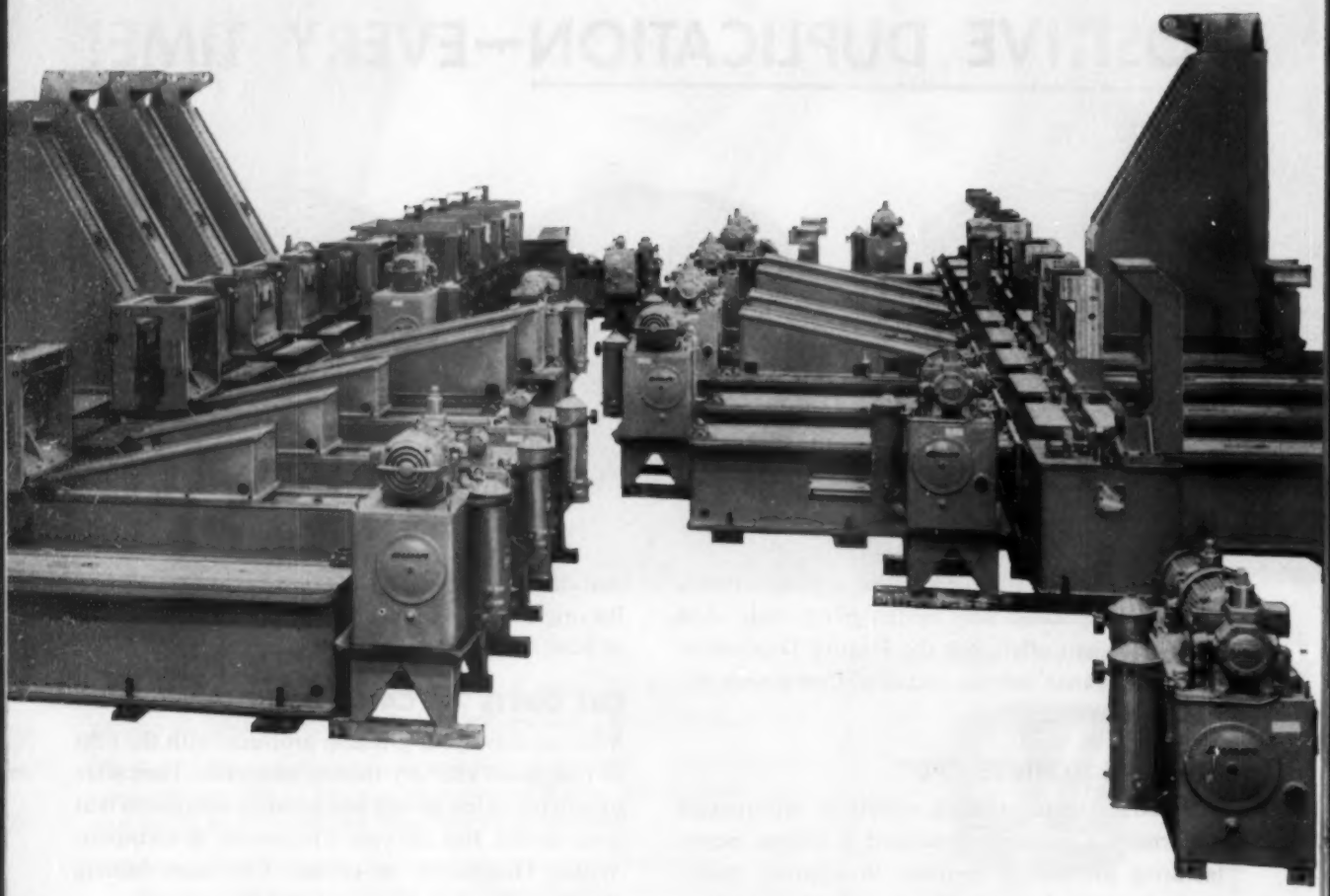
°Trade Mark Reg. U.S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

Report to the **SMTS*** *Committee*

*SPECIAL MACHINE TOOL STANDARDS

GESTATION PERIOD:



MMT-PE

BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICHIGAN

.....everything's fine with BUHR'S "BABY"

Standard building block by standard building block, Buhr's Baby is fast taking shape. Wing bases, center bases and other standardized components are being assembled and made ready to receive special tooling and auxiliary features which are being completed.

Buhr's Baby, as you may know, is to be an Economatic lift-and-carry transfer—the first major piece of equipment to be built to the Special Machine Tool Standards. This "Baby" will perform 323 precision operations in automatic sequence and will be the most flexible and readily convertible multiple operation machine tool ever built.

BUHR

(say BURE)

ECONOMATIC

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.5
1.
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FEDERAL
JEWELED
DIMENSIONAIR
FEDERAL PRODUCTS CORPORATION
PROVIDENCE, R.I. U.S.A.
.00005"
50
FEDERAL
FEDERAL
1.0000
MASTER
1.0000 XX

NO

DOUBT ABOUT IT

. . . that's why the

DIMENSIONAIR

is the best air gage you can buy!

No doubt about the Dimensionair's readings

Such sharply defined calibration — the mark of a truly accurate gage — obviously gives you greater resolution, much finer readings than broadly defined graduations and wide hands or air-suspended markers ever can. Each time you gage with the Dimensionair, the needle-thin indicating hand advances smoothly, comes to a positive stop, yet is responsive to the slightest change. Its position in relation to the fine-line graduations is unmistakable. Such decisiveness, coupled with Dimensionair sensitivity, means much greater readability. In fact, tests prove that you get more information from the Dimensionair than from other air gages having *twice* the magnification.

No doubt that the Dimensionair maintains its accuracy

Dimensionair magnification is built-in . . . fixed. No adjustment can change it. That's why the Dimensionair, once set, *stays* set. Air pressure variations cannot affect the accuracy of the Dimensionair. Its balanced air circuit cancels them out, This achieves a stability which cannot be approached by other air gages.

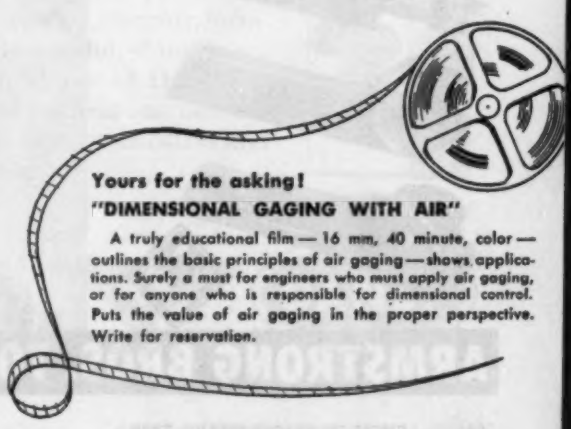
No doubt the Dimensionair is easiest to use

Its fixed magnification and protection against drift guarantees *linear, calibrated* accuracy so you need only *one* master for set up . . . make only *one* adjustment to set zero. You're ready to gage in less than ten seconds! Dimensionair design gives you wide range operation (up to .006" depending on model selected)*. You also get greater plug clearance and more deeply recessed gaging jets for faster, easier gaging and longer life than is possible with other air gages.

All these advantages are based on the fact that the Dimensionair, unlike other air gages, is *built* to a specific accuracy and magnification. This is an important difference, as thousands of Dimensionair users can tell you. But don't just take our word for it . . . see for yourself. We will be glad to demonstrate the Dimensionair to you, either by itself or against any other air gage. We have offices all over the country. There's a Dimensionair near you, ready to be demonstrated.

FEDERAL PRODUCTS CORPORATION
6125 Eddy Street · Providence 1, R. I.

*FIVE MAGNIFICATIONS TO CHOOSE FROM:
1,250:1 (.006" range, each grad. = .0001")
2,500:1 (.003" range, each grad. = .00005")
5,000:1 (.0015" range, each grad. = .00002")
10,000:1 (.0006" range, each grad. = .00001")
20,000:1 (.0003" range, each grad. = .000005")



Yours for the asking!
"DIMENSIONAL GAGING WITH AIR"

A truly educational film — 16 mm, 40 minute, color — outlines the basic principles of air gaging — shows applications. Surely a must for engineers who must apply air gaging, or for anyone who is responsible for dimensional control. Puts the value of air gaging in the proper perspective. Write for reservation.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

ARMSTRONG
TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs. Write for literature.

If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. CHICAGO 46, ILL.

90 STANDARD SIZES

in a Custom-Quality Press

Take your choice of dependable Danly SC crankshaft presses in capacities from 50 to 300 tons...bed areas to 72″ x 60″...with strokes to 16″...constant or variable speeds to 90 SPM... with non-geared, single or double-geared drives...equipped for manual or automatic feed.

Every SC press gives you Danly's patented low-maintenance air-friction clutch, husky welded-steel frame, and countless other custom-quality features.

For low-cost piece part production ...in blanking, drawing, piercing, forming, or progressive die stamping... you'll find your choice of Danly SC Presses ahead of the field and best for you. WRITE FOR NEW SC CATALOG and get all the details.

MMT-PE

DANLY

DANLY®

DANLY MACHINE SPECIALTIES, INC., 2100 S. LARAMIE AVE., CHICAGO 50, ILLINOIS

MODERN MACHINE TOOLS
MMT-PE
PRODUCTION EFFICIENCY

See multicycle hobbing at 1960 Machine Tool Exposition... Booth No. 923.

Here is one of the most promising machine tool developments for general-purpose gear cutting in the history of modern hobbing.

61%

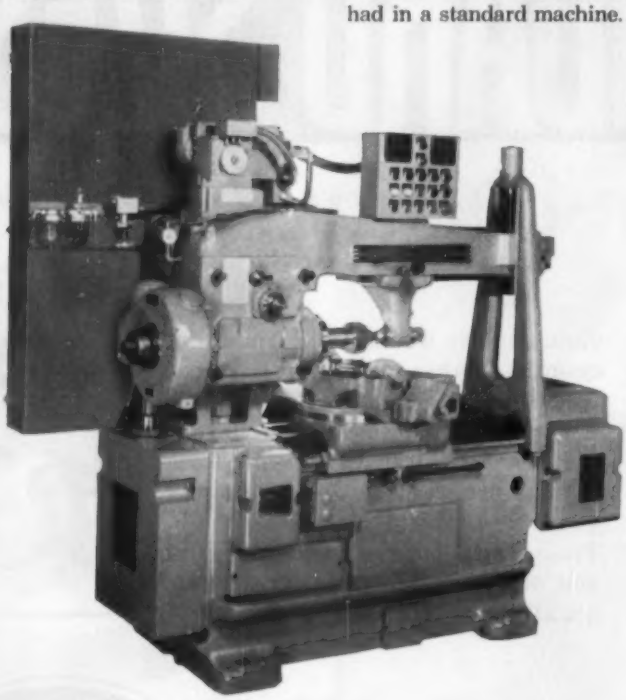
...on New

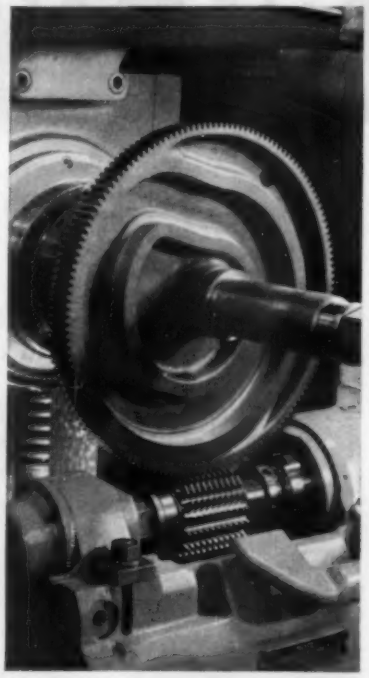
Now, faster production through reduced cutting time and easier setup is a practical reality for a wide range of work. Barber-Colman's new No. 16-16 multicycle machine reduces nonproductive machine time greatly. Job studies noted on the opposite page are typical of what you can expect without a change in material specifications or hob life. Annual savings for the full range of work produced on this machine would show a significant increase in profits.

Hobbing worm gears, splines, helical gears, or spur gears—in 1- or 100-piece lots—you can trim valuable minutes from cycle time without sacrificing finish or hob life. The larger the hob, the more time you save—because nonproductive approach usually can be reduced considerably with the plunge-approach cycle.

This is automatic hobbing at its best, with power vertical feed and conventional horizontal feed—also with more real versatility than you ever had in a standard machine. Any of three automatic cycles can be chosen by turning a switch.

1. *Square cycle*—automatic version of conventional hobbing cycle, with rapid positioning of workslide and rapid return of the hob carriage.
2. *Plunge cycle*—automatic vertical feed, with infinitely variable downfeed and rapid positioning of the workslide.
3. *Plunge-approach cycle*—combination of the above to provide shortest possible approach to full depth.





MORE GEARS

Multicycle Hobbing Machine

Once setup is completed, the operator loads, presses the start button, and unloads manually. The big difference is in the way the hob and work are positioned—faster, accurately, automatically, and in the most direct manner.

In reviewing these possibilities for your plant, consider the added advantage of variable downfeed. A worm gear job formerly was done on a conventional machine. With a feed rate of .007″ per revolution, followed by a four-revolution dwell, and with a hob speed of 103 rpm, floor-to-floor time was 4.83 minutes.

The same job on the multicycle is done in 3 minutes, floor to floor. Setup time has been reduced from 67 minutes to 55 minutes.

Part of this saving results from constantly variable vertical feed. This provides a high feed rate at the start of the cycle when chip load is light . . . light feed at full depth when chip load is heavy. The *average* feed of .018″ per revolution is more than double that used on the change-gear-type machine.

Multicycle machines are now in production in both the Nos. 6-10 and 16-16 sizes. Call your Barber-Colman field representative or write the factory for delivery information.

Barber-Colman Company

BARBER COLMAN ®

51 Loomis Street, Rockford, Illinois

TYPICAL SAVINGS WITH MULTICYCLE HOBBING

JOB FACTS	Cast Bronze Worm Gear		Cast Iron Spur Gear (shown at left)	
	Conventional (Vertical Feed)	Multicycle (Variable Feed)	Conventional	Multicycle (Plunge Approach)
Hob speed (rpm)	103	120	246	246
Horizontal feed (ipr)	....	....	.060	.060
Vertical feed (ipr)	.007	.018 (average)	....	.030
Approach Distance (in)	....	....	.700	.360
Dwell	4 rev.	24 seconds	....	....
Pieces per hour	12.42	20	6.94	8.68
Setup time (min.)	67	55	85	85
Production increase		61%		25%

New, large capacity New Britain bar machines

If you feel you know New Britain bar machines like a book, a word of caution: There's a completely new book! New, basic design that removes limitations formerly inherent in bar machine construction. New power, new speed, completely new capability for imaginative tooling.

And new, large bar capacity. That is the important "new" we want to call to your particular attention here. You can apply New Britain standards of productivity to bar stock as large as 5⅛".

The new, big line of four-, six-, and eight-spindle models:

Model 450. Four spindles, 5⅛" maximum capacity, four independently operated radial cross slides.

Model 635. Six spindles, 3½" capacity, with independent radial cross slide in every position.

Model 826. Eight spindles, 2⅝", capacity. Six independently operated cross slides with the two lower slides exceptionally wide to provide elevating blocks for cross slide tooling in the number 3 and 8 positions.

Inexpensive, disc-type cams provide positive actuation of cross slides. Cross slide and end-working tools on all models are easily accessible. All models have positive spindle carrier lifting, locating and locking. New catalog material will give you further details on these machines. Your New Britain representative can show you how the increased profitability built into them can improve your competitive situation. Plan to see him soon.

THE NEW BRITAIN MACHINE COMPANY

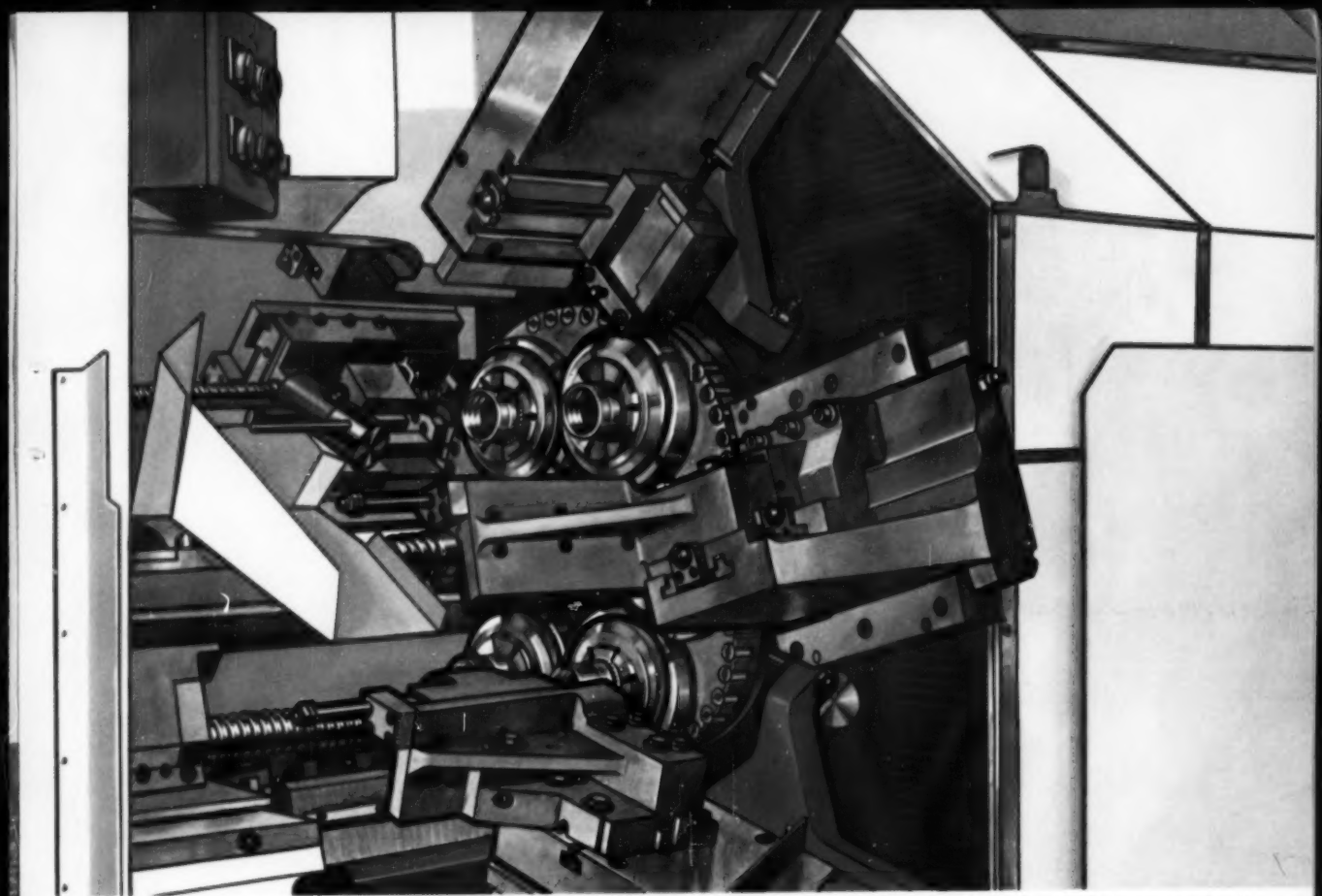
Capacity up to 15" on New Britain chuckers

We are going to take it for granted that *you* take New Britain chuckers for granted—as the leading make of multiple spindle automatics. Most people do. The big news then is that the profitability of these famous machine tools can now be applied to an increased range of work. The new New Britains are available with chucking capacities up to 15", which enables you to apply New Britain standards of speed, accuracy and versatility to larger work.

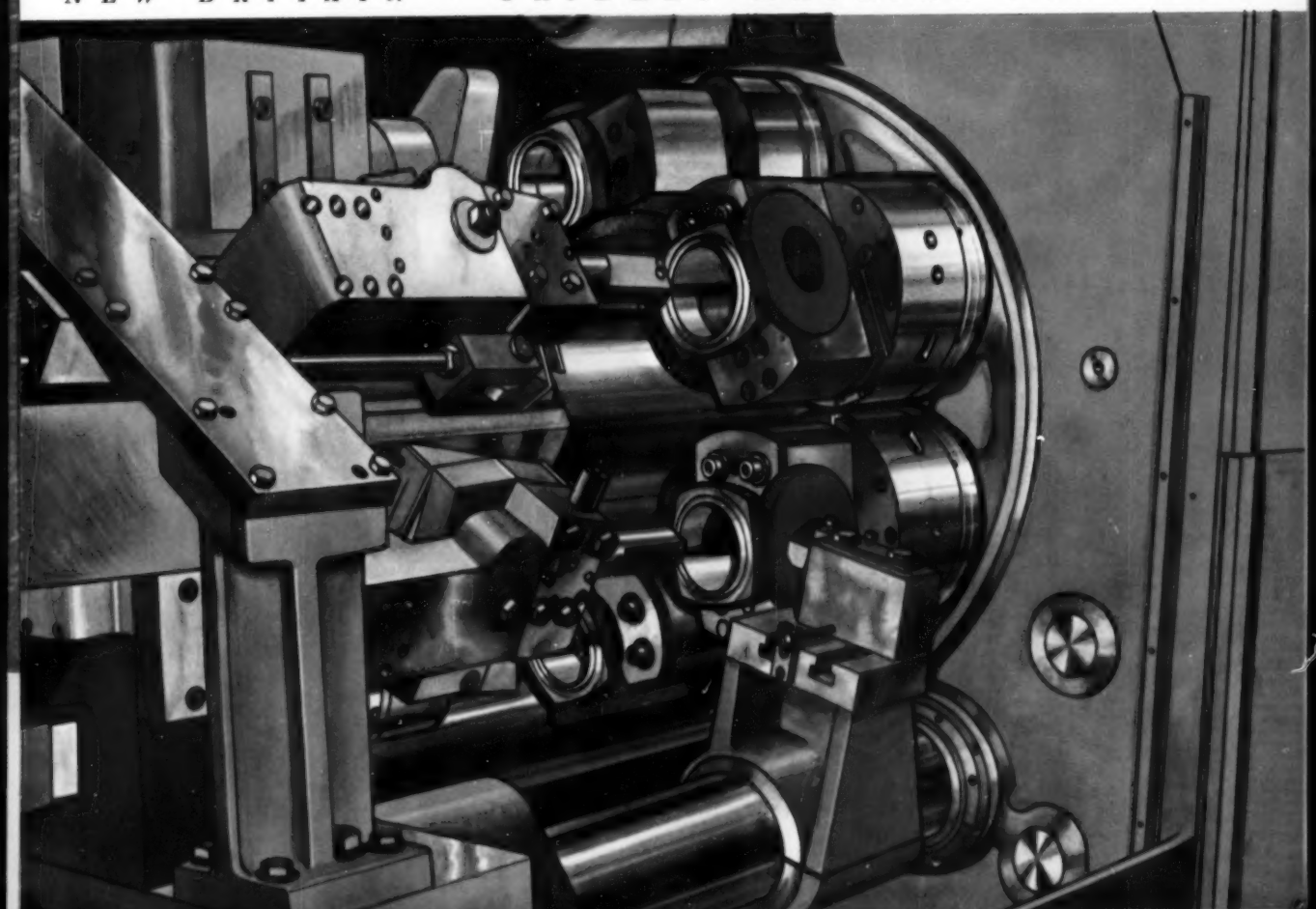
The 15" capacity applies to four-spindle models. Six-spindle machines will take pieces up to 12", and eight-spindle chuckers will handle up to 10".

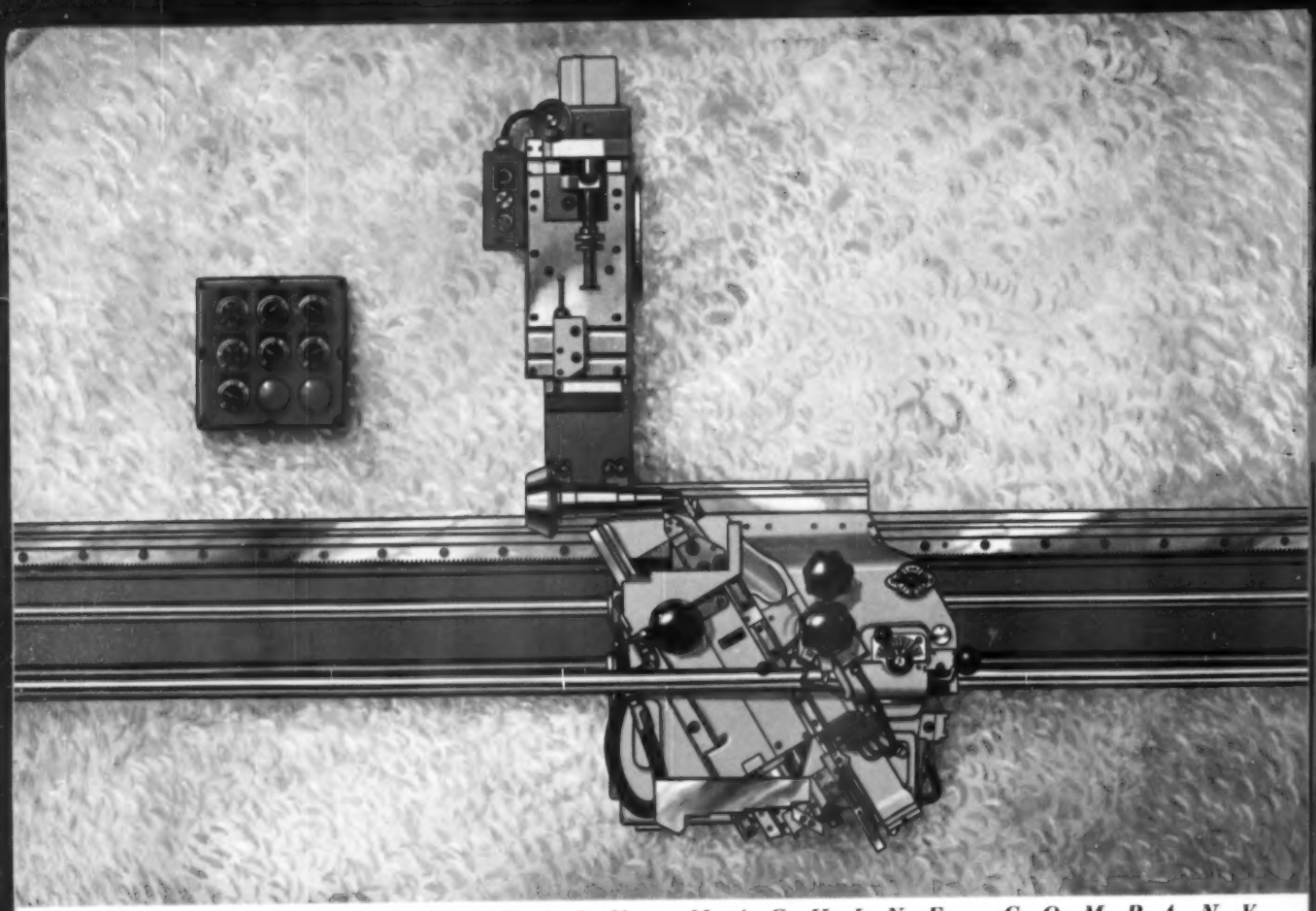
If you work with large castings and forgings, this might be the announcement of the decade, in terms of an investment that can't fail to be profitable. With equipment like this properly adapted to your particular requirements, nobody, anywhere, is going to trim you on cost per piece.

Call on your New Britain sales engineer for practical, specific information, of course. Meanwhile, we have just published a new catalog on these new large capacity chuckers, and we would be happy to mail your copy to you on request. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

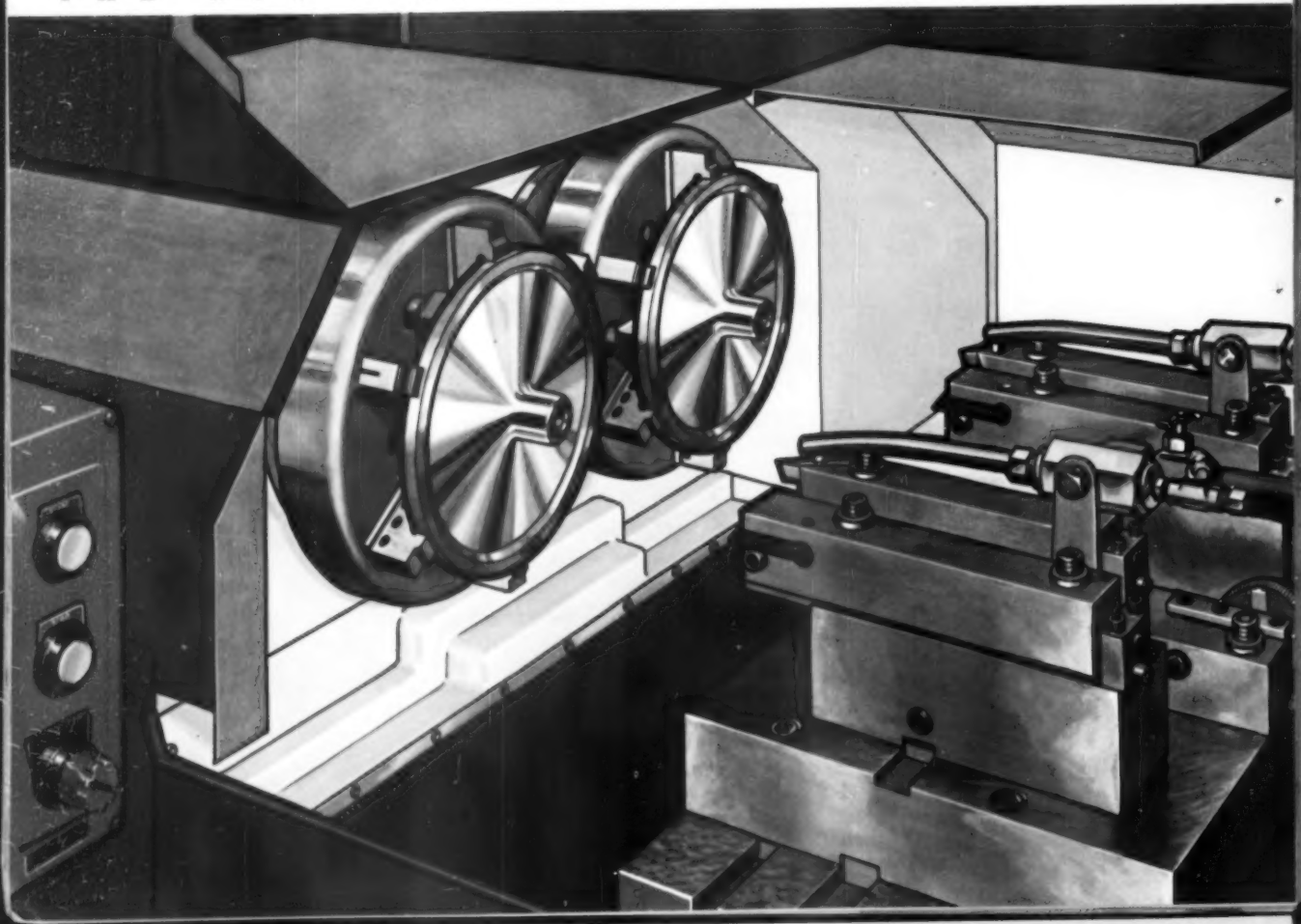


NEW BRITAIN - GRIDLEY MACHINE DIVISION





THE NEW BRITAIN MACHINE COMPANY



Fast, rugged New Britain +GF+ copy lathes

Right from the ground up the New Britain +GF+ is a machine conceived, designed and manufactured as a copying-contouring lathe. Not a standard lathe with copying attachment; not a factory-made "special" with the contouring feature built on components from other lathes; but a solidly based, ruggedly constructed, fast, powerful, accurate machine designed solely for the template-controlled, rapid production of between-centers or chucked work with external or internal contouring.

A million pieces or just a few, it's a machine you'll use on many different types of short-run jobs (just change the template and reset the controls), or on one long-run job (just replace the single-point tool when it wears).

The instantaneously accurate hydraulic copying mechanism is entirely enclosed within the compact carriage. All controls are within easy reach. The template is up front for easy adjustment. The chips fall free into the wide open base, can't clog or jam any part of the mechanism.

There are endless variations available within the New Britain +GF+ line. The standard model has applications anywhere on between-centers or chucked pieces. Other attachments and models are available to suit your particular requirements; infeed attachments, automatic loading, bar stock models, etc.

Don't buy any lathe or "special" for copy turning until you have investigated the New Britain +GF+ copy turning lathe. As a starter, may we send you the latest catalog?

NEW BRITAIN · GRIDLEY MACHINE DIVISION

Consistent accuracy to tenths at super speeds

Model 37 Precision Boring Machine is a machine with a mission, rather than an answer to everybody's metal turning problems. Its mission is contour boring and turning in applications where both extreme repetitive accuracy and high production are of paramount importance. If you have such a requirement, Model 37 is an unbeatable money-maker.

It is an inherently simple machine: simple to operate, with inspection limited to gauging any one dimension. Simple in operating principle, too, built around precision cams that operate without being affected by temperature fluctuation. From one to four high speed spindles can be mounted on a single machine.

We would be happy to discuss *any* production problem involving straight or contour boring and turning. We doubt that anyone equals New Britain's know-how in this area, and we have a wide variety of boring equipment, both vertical and horizontal and of very advanced design. No matter what your work, or production requirements, this is a very fine place to look for an answer. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

new Westinghouse WS silicon welder...

Arc-air gouging for metal removal offers an outstanding path to cost reduction. The new Westinghouse WS welder has been designed as the ideal companion to this process.

Weld or gouge—be SURE you do it with the 500-amp WS because, in addition to the natural advantages of a hermetically sealed, high capacity, silicon diode rectifier, it affords threefold protection.

Three automatic protection features eliminate the need for special precautions by the operator. First: an exclusive surge suppressor circuit to protect against transient voltage spikes. Second: an integral transformer thermal switch that prevents overheating with prolonged use. Third: an exclusive time and current sensing

(Below) The gouge and the gouging.

CIRCLE 201 READER SERVICE CARD

designed specifically for arc-air gouging, too!

relay circuit that prevents damage from the above normal current or above normal duty cycle.

You benefit with greater production and fewer repair bills. What's more, you have a dual-purpose unit that can both weld and arc-air gouge, a welder you can count on to work whenever you need it.

You can get other Westinghouse WS units with the same ruggedness and reliability. Capacities: 200, 300, 400 as well as 500 amps for 230/460-volt a-c operation.

Want more information on the industry's newest, most versatile welder? Contact your nearest Westinghouse Welding Distributor . . . or write Westinghouse Welding Division, 4454 Genesee Street, Buffalo 5, New York.

J-10488

watch Westinghouse for new developments in welding!

YOU CAN BE SURE...IF IT'S **Westinghouse**

The new WS welder.

CIRCLE 202 READER SERVICE CARD

How INDEX TABLE *DESIGN* affects INITIAL PRICE and TOTAL COST

Study these drawings to see how the design of an index table affects total costs of an installation. Some tables may be priced lower than others initially, but the additional charges for auxiliary items to adapt them to production requirements, added to maintenance and downtime costs, can make a drastic difference in the total price.

The Ferguson Intermittor, indexed by a roller gear drive which operates a minimum of 8,000 hours at speeds up to 2,000 indexes a minute without maintenance, needs no auxiliary locking. It is designed for high speed operation and incorporates rigid integral supports for tooling to eliminate expensive segmental components. The Intermittor dial is supported by tapered roller thrust bearings to withstand heavy loads with little friction. A stationary center tooling support is held rigidly at its top by anti-friction radial bearings and at the bottom by a flanged base bolted to the housing. Hollow center of the support may be used for passage of coolants, fluids, air or vertical shafts to transmit motion to the work surface.

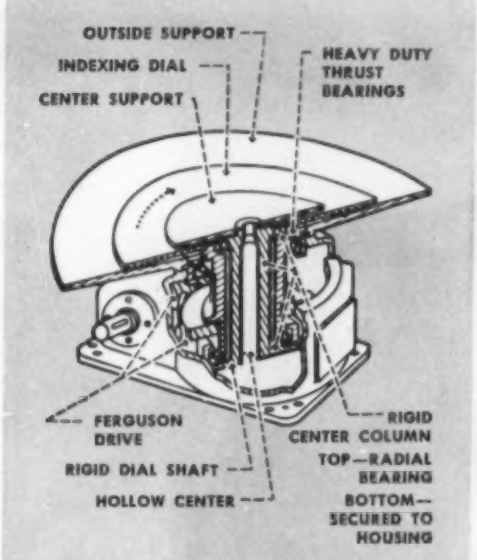


FIG. 1—FERGUSON INTERMITTOR

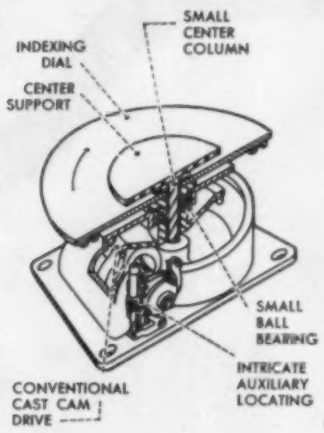


FIG. 2—BARREL CAM TYPE

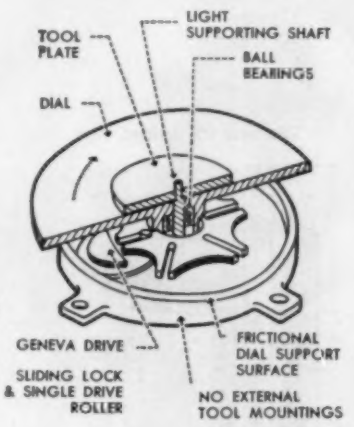


FIG. 3—GENEVA DRIVE TYPE

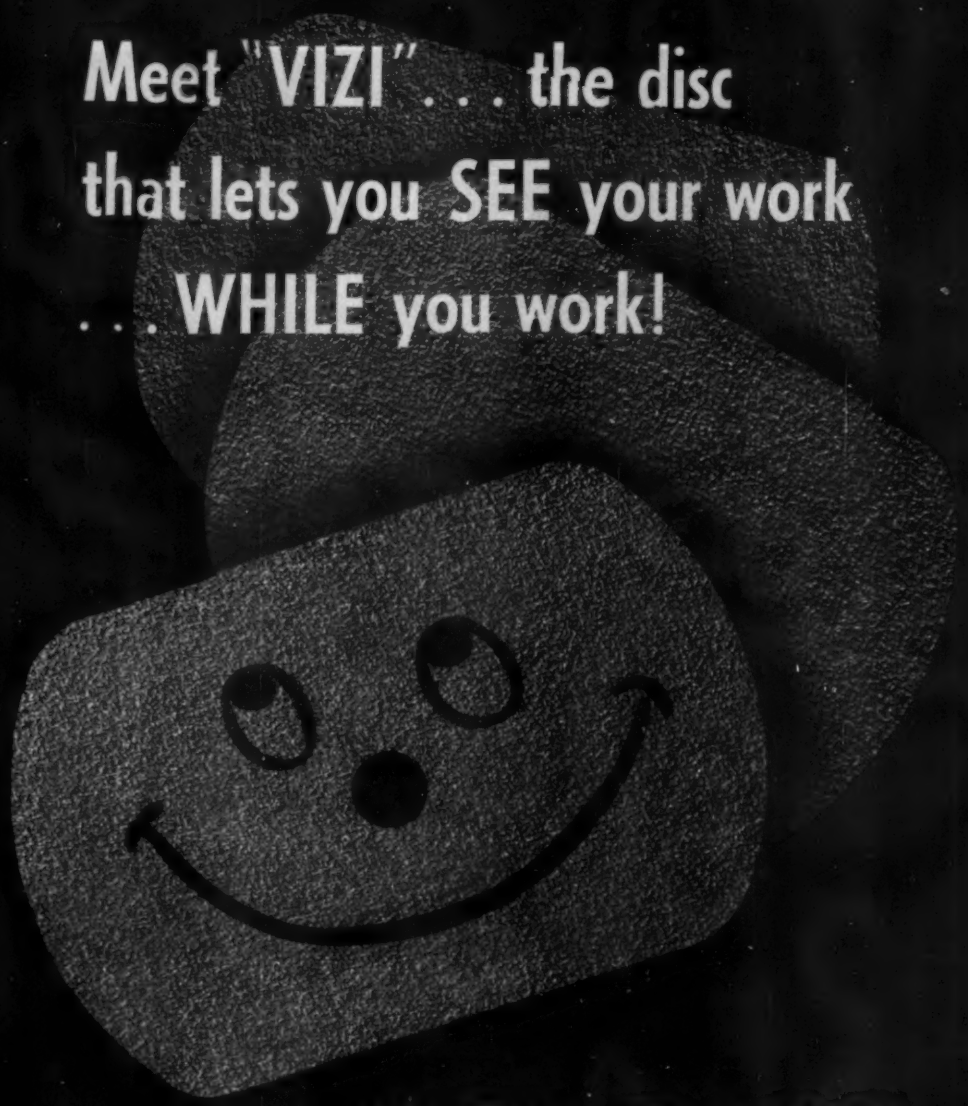
Figures 2 and 3 show typical barrel cam and geneva drive index tables. Their indexing mechanisms limit operating speeds, therefore other components may be "designed down." Shafts and bearings are lighter; frictional support surfaces might be employed instead of thrust bearings and an auxiliary locking or locating device is a costly necessity for even modest accuracy requirements. Tool mounting methods are often provided at additional expense and sometimes even ignored. Difficulties of installation and frequent maintenance downtime can increase total cost drastically.

• SEND FOR CATALOG

Many other advantages result from the selection of a Ferguson Intermittor. Compare designs in new Catalog No. 160 which contains data on more than 175 standard tables. Every design engineer should have a copy. Get yours by writing:

FERGUSON
MACHINE CORPORATION
A subsidiary of Universal Match Corporation
7818 Maplewood Industrial Court
St. Louis 17, Missouri

Meet "VIZI" . . . the disc that lets you SEE your work . . . WHILE you work!



The VIZI-DISC

Here is the VIZI-DISC mounted on a portable grinder ready to run. Note the unique shape.

As the grinder starts we get a spinning pattern similar to a propeller or electric fan blade.

Operator can "look through" the VIZI-DISC as grinder turns-over at full rpm.

This is what everyone is talking about. The new METALITE VIZI-DISC lets you see the exact area where the work is being done. Its unique shape gives it "see through" like a blade of an electric fan or an airplane propeller. This amazing new disc actually cools itself while it's cutting. And, because there is no blind spot, you grind only the area that needs to be smoothed, thus increasing disc life. VIZI-PADS to back-up the VIZI-DISC are available. They have a herringbone non-skid face that grips the abrasive disc, and guarantees an aggressive rate-of-cut. You can get a free demonstration from a Behr-Manning representative or write Dept. AM-5.

BEHR-MANNING CO.

TROY, NEW YORK

A DIVISION OF NORTON COMPANY (NORTON)

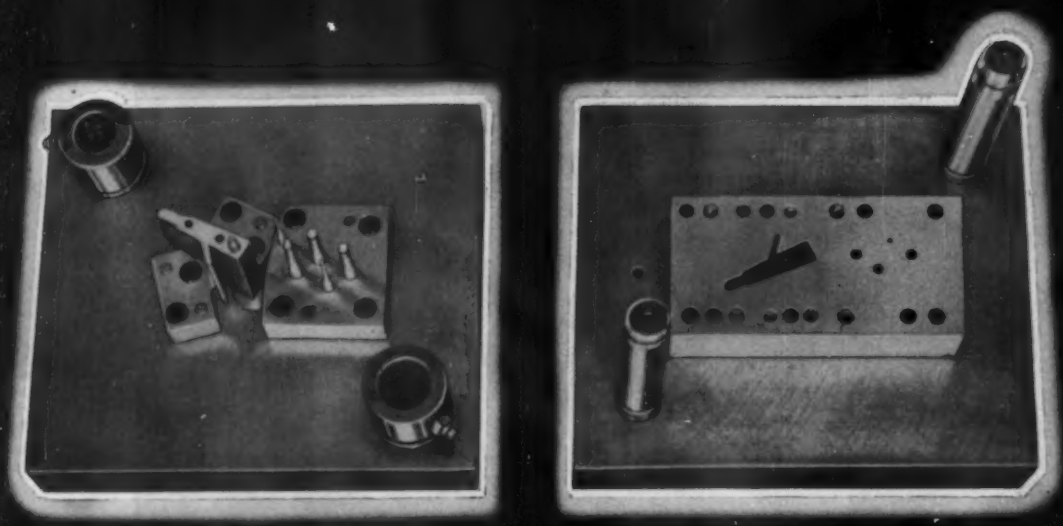
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes • Floor Maintenance Products
NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals
In Canada: Behr-Manning (Canada) Ltd., Brantford. • For Export: Norton International Inc., Troy, New York, U. S. A.

CIRCLE 204 READER SERVICE CARD

THIS PROGRESSIVE DIE MADE WITH...

25% LESS MACHINING TIME

40% LESS GRINDING



LO-AIR TOOL and DIE STEEL

Low Temperature · Air Hardening*

. . . CUTS PRODUCTION COSTS

Accurate Machine and Tool Company of Roselle Park, N.J., reports savings of 40% in grinding and 25% in machining time on this progressive die—through the use of LO-AIR, the tool and die steel that is easy to machine —has least distortion in hardening.

On oil hardening tool steels, previously used for this die, .015" was allowed on sides for grinding and .005" in jig bored holes before heat treating. With LO-AIR they found it safe to allow not more than .0025" on sides and no extra in holes before hardening—making great savings possible.

For complete information, write today for Performance Report No. 20. Also, we will gladly send you a copy of our 12-page LO-AIR brochure on applications, properties and other technical data. For immediate delivery of LO-AIR, call our nearest sales office or warehouse. Complete stocks available.

*U.S. Pat. No. 2,355,224

UNIVERSAL CYCLOPS

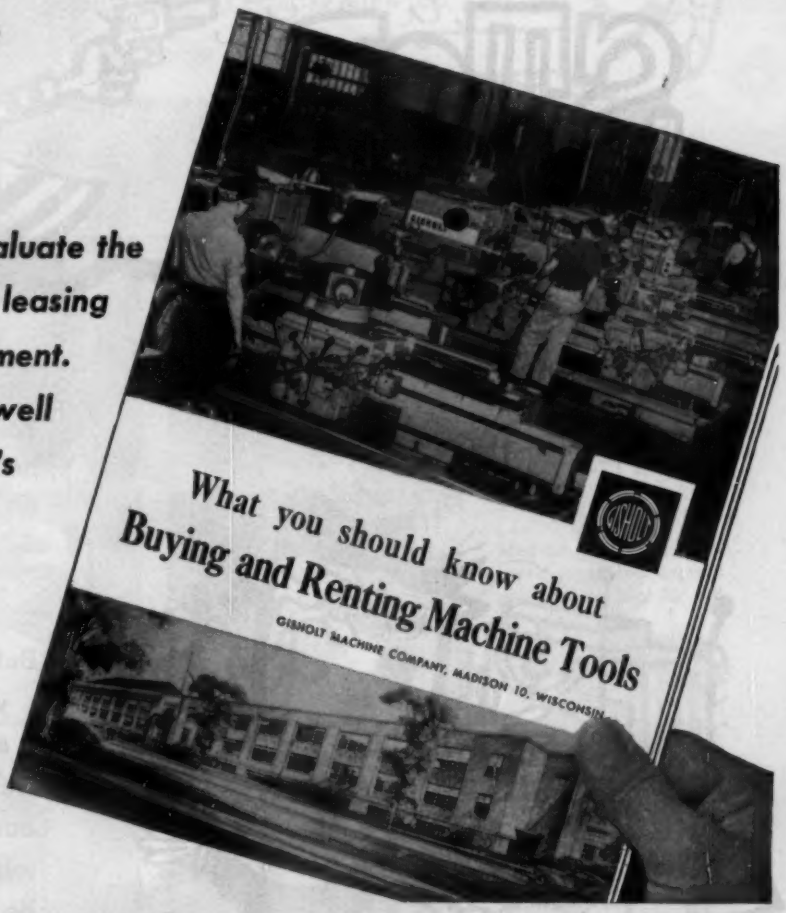
STEEL CORPORATION

EXECUTIVE OFFICES: BRIDGEVILLE, PA.

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

Can your competitors turn metal at lower costs?

***Now** is the time to re-evaluate the possibilities offered by leasing of new production equipment. Your decision today can well determine your company's position in tomorrow's competitive market.*



This free booklet tells how you can get new machines with minimum capital outlay

If you have delayed replacing old machines because of the relatively large capital investment, acquisition by methods other than outright purchase may solve your problems. Only a minimum initial investment provides you with the many competitive advantages that new machines offer, including greater accuracy, higher production rates and faster setup. New features and accessories simplify even the toughest jobs. Secondary operations are minimized and spoiled work becomes a thing of the past. All this means lower unit cost—more profit for you.

If you want the benefits that new machine tools can provide, and if you like the idea of letting them "pay their way" while they "turn" a profit for you, you'll want to write for Gisholt Bulletin 1173 on buying and renting machine tools. It fully explains one of the most liberal and comprehensive policies in the industry, and covers several types of leasing and time payment plans with vital information on depreciation, tax angles, the MAPI formula and other timely questions. The coupon will bring your free copy. Send it along today.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT MACHINES WITH NEW-MACHINE GUARANTEE

Gisholt Machine Company
1201 Washington Ave.
Madison 10, Wisconsin

Without obligation, please send your Bulletin 1173.

Name.....*Title*.....

Company.....

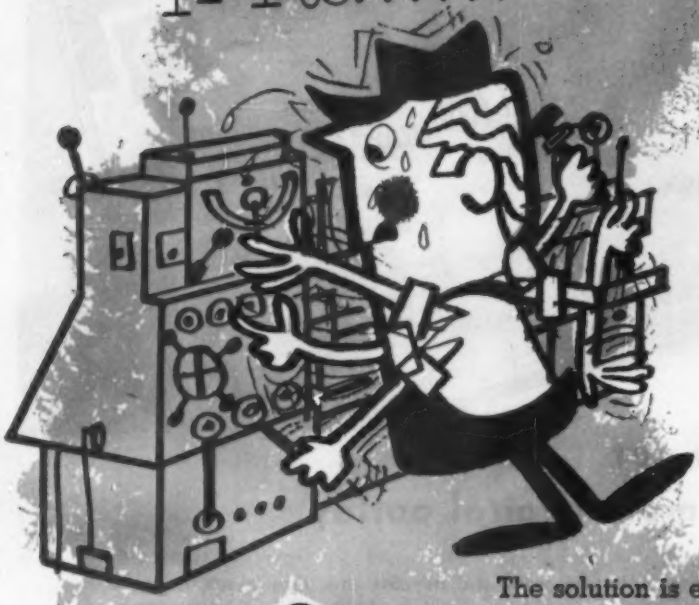
Street address.....

City.....*Zone*.....*State*.....

STOP

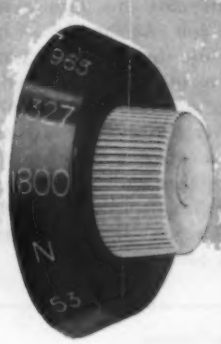
these men from stealing your profits.....

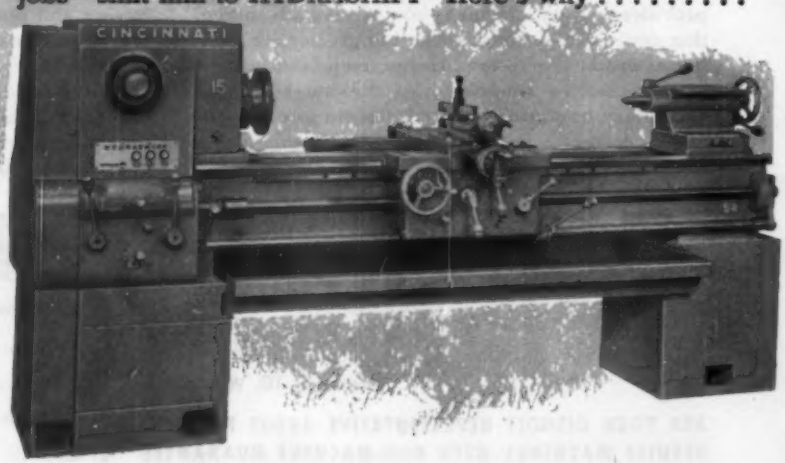
You know about this fellow . . . he's stealing "cash", and you do try to stop him.



But **YOU** cause this theft . . .
you force this man to steal your profits . . .
make him add to labor and burden costs on most lathe jobs, no matter how hard he works.

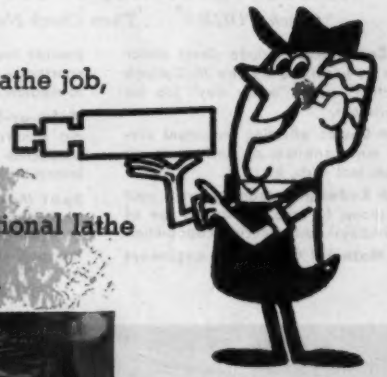
The solution is easy:
make your operator a *cost-reducer* on ALL of his lathe jobs—shift him to HYDRASHIFT* Here's why .....





*HYDRASHIFT is Cincinnati's new lathe line with *the new way to change spindle speeds . . . hydraulically!*

Compare the machining of this typical lathe job, two steps and two necks on the new HYDRASHIFT . . . on a conventional lathe



As second step is being cut, operator turns the dial to speed required for the necking cut.

Operator waits for machine to complete the step cuts.

Step cuts completed, operator changes to necking tool (he had it lying on the convenient Tray-Top) and positions tool for cut.

Step cuts completed, operator changes to necking tool and positions tool for cut.

Operator engages spindle lever and cuts the neck—*without leaving apron.*

Operator goes to headstock, shifts various levers to change to spindle speed for necking cut.

Necking cuts completed, operator changes tools for next workpiece.

Operator returns to apron, engages spindle lever, and cuts the neck.

Don't force your lathe operators to steal profits from your pockets—take a look at the new Cincinnati HYDRASHIFT Lathes at your nearby Cincinnati Lathe and Tool Dealer's showroom. If you can't reach him immediately, wire collect!

CINCINNATI LATHE AND TOOL CO. CINCINNATI 9, OHIO

HYDRASHIFT Lathes/CINCINNATI Drilling Machines/SPIROPOINT Drill Sharpeners

NATIONAL ACME'S "ZONE OF RESPONSIBILITY"
INCLUDES ALL PHASES OF COST REDUCTION
Check YOURS . . . Then Check National Acme

Direct Costs: these include direct dollar savings as realized by the McCulloch Corporation . . . an "every day" job for Acme-Gridleys.

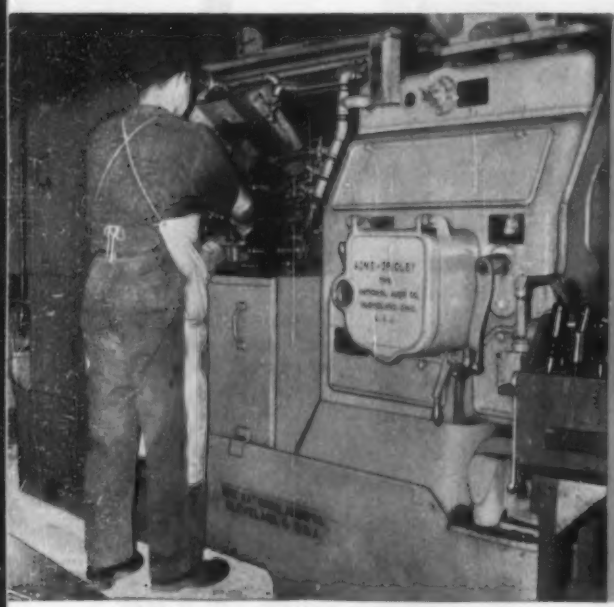
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

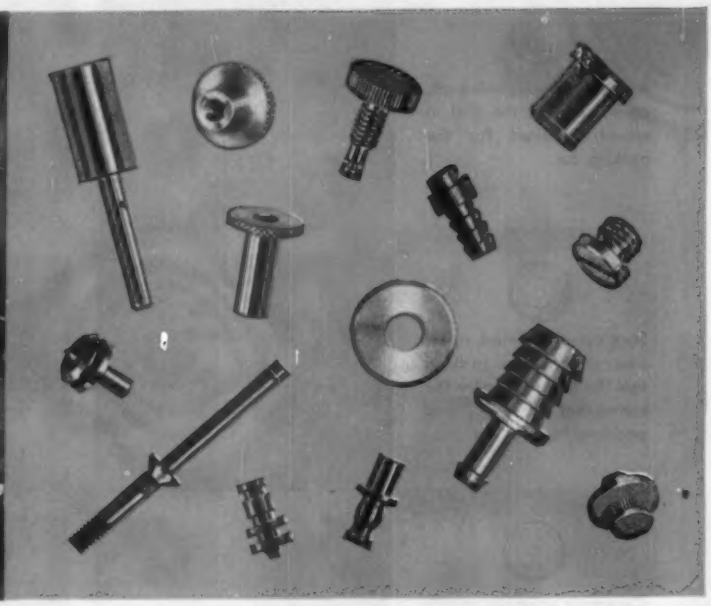
Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.





McCULLOCH CORPORATION LOGS 66% COST REDUCTION

. . . with Acme-Gridleys

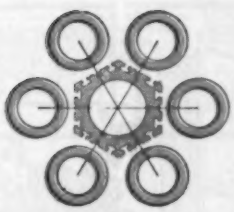
Reduced cost-per-piece of tilt-lock knobs was but one of the enviable savings made possible for the Marine Products Division of the McCulloch Corporation by an Acme-Gridley RA-6 Spindle Automatic. In addition, McCulloch boosted output 200%, practically eliminated scrap losses, and greatly improved finish and final appearance of this small but critical part.

Previous production methods required one primary and two secondary operations. Now, complete machining—including deburring, is done in one automatic operation on the Acme-Gridley.

Dramatic savings in the production of parts like this make Acme-Gridleys a vital, cost-saving cog in McCulloch's highly efficient production set-up. Evidence of this leading manufacturer's high regard for Acme-Gridley efficiency is the fact that 14 different parts for their popular 60HP "Flying Scott" are produced on the rugged, versatile RA-6 Automatic.

It will pay you to thoroughly study the savings possible with Acme-Gridleys. Call, write or wire for complete details on industry's most modern approach to tangible cost reduction.

Pioneer in Circumferential Automation

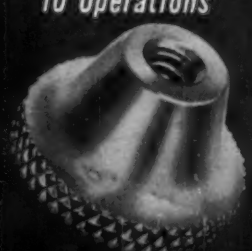


National Acme

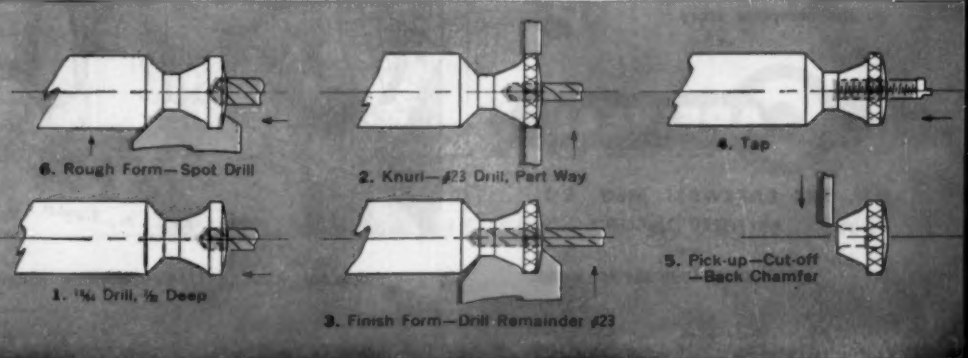
The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

10 Operations



in 5 Seconds


6. Rough Form—Spot Drill
2. Knurl—#23 Drill, Part Way
4. Tap
1. ¹³⁄₆₄ Drill, ⅛ Deep
5. Pick-up—Cut-off —Back Chamfer
3. Finish Form—Drill Remainder #23

ONLY

CAPEWELL

is the originator and developer of the revolutionary new L-100-M

SPEED-BAND®

double carbide Band Saws

ONLY

available from authorized CAPEWELL Distributors

Ask your Capewell Distributor for the complete story

CAPEWELL

THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Where's the Secrecy?

Dear Sirs:

On your "Detroit" page under the heading, "Why the secrecy?" (*AM/MM*—Mar 21 '60, p97), you imply that the automobile companies, in order to protect the commercial advantages of their innovations, maintain secrecy policies that are detrimental to their suppliers.

As one of the principal suppliers for the automotive industry for a good many years, we feel it only fair to state that, in our experience, the industry has been above reproach. While it is true that the automobile companies make every effort to avoid needless publicizing of their plans, it is also true that they have been careful to keep us advised of changes in their plans which might affect our future.

Possibly smaller suppliers or those not so well identified with the industry are not kept as well informed. However, our own experience would indicate a very conscientious effort to treat major suppliers as the partners which they are.

You cite the case of Midland-Ross which shut down its Detroit operation as a result of losing the Chrysler frame business in the summer of 1959. Since we were a part of the competitive negotiation which resulted in this shutdown, we can state that your analysis is not accurate.

Midland-Ross did not shut down as a result of an unannounced change in Chrysler's operations, but rather because Chrysler decided to reduce the number of its outside frame suppliers from three (The Budd Co, Midland-Ross, and A O Smith) to one. They also planned to establish their own frame manufacturing operation. The Budd Co won this competition, so Midland-Ross and A O Smith are not now supplying Chrysler with frames (except for the Imperial frame which we still build).

While we may argue the merits of integration of activities by the major automotive companies, we should not misrepresent this integration as a lack of communication with suppliers. I feel sure that Midland-Ross, like ourselves, was fully aware of their customer's plans.

You state that "It is well known that General Motors plans a switch to unitized bodies in 1963.

SHOPMATES

N. Jarvis

PSSSST!! PSSST!!
HERE HE COMES — BARKER!! HE LOOKS MADDER THAN A BUSHEL OF BEES — MUST A' GOT BAWLED OUT UP FRONT!!
NAW!! HE POPS IN AND CATCHES US ALL WORKIN' — NOW HE THINKS WE BEEN UP TO SOMETHIN'!
N. JARVIS

No other tracer attachment has all these features

Traces from any template (round, flat, wood, metal) or standard product.

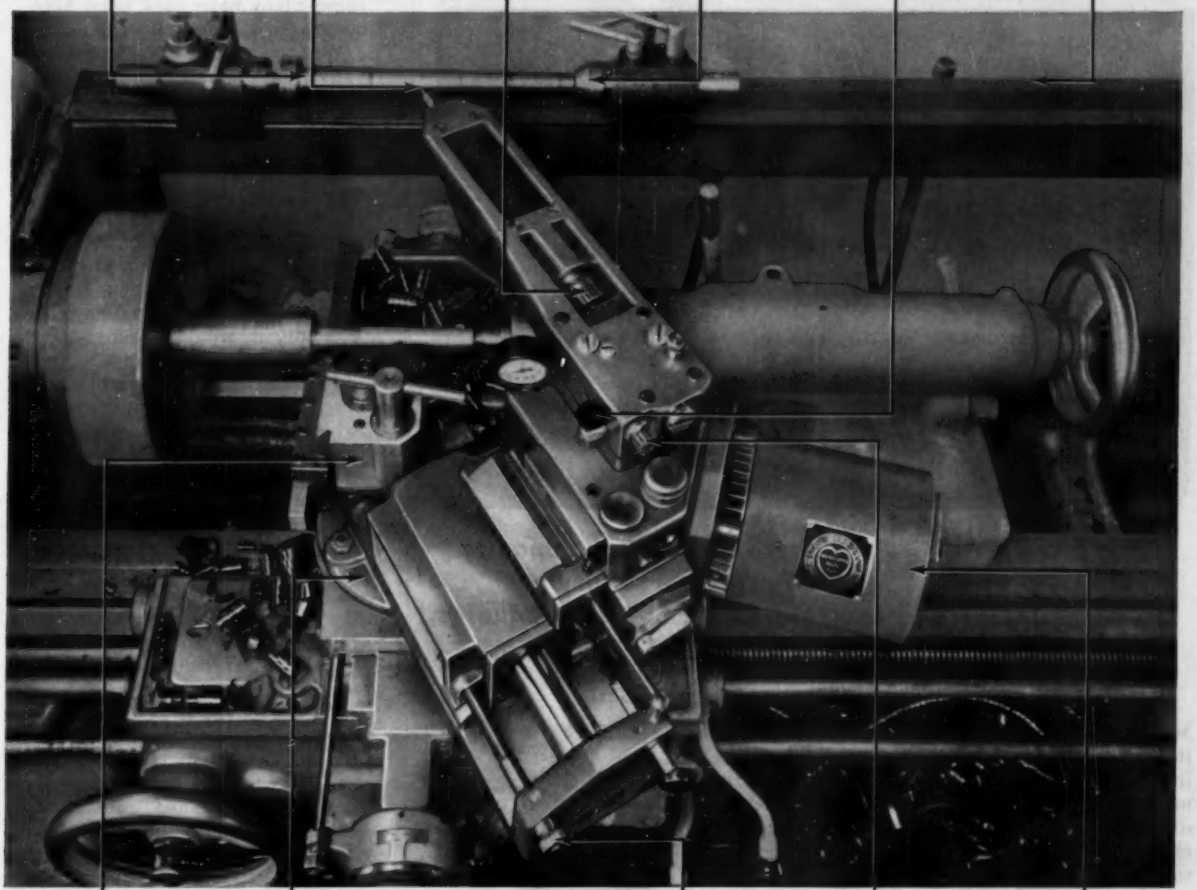
Tracer controls tool in continuous path for smooth, accurate finish.

Micrometer adjusts for cutting over, under or exact size.

Adjustable eccentric on template protects lathe tailstock.

Easy-to-reach control knob initiates or interrupts cycle.

Template rails furnished any length and with brackets to fit any lathe.



Tool post and holders designed for quick change of pre-set tools.

Complete swiveling for turning, boring or internal cutting at any angle.

Does not limit utility of lathe . . . regular turning can be done with tracer installed.

Positive stop locks unit for non-tracing cuts.

Adjustable valve controls feed rate for non-tracing work.

Close-coupled motor and pump eliminates hoses, assures sensitive control.

For far less than you would imagine, you can quickly convert any good lathe for turning multiple diameter shafts or for turning, facing and boring contoured workpieces . . . single pieces or high production. Three sizes to fit any lathe up to 27½" swing and up to 30 horsepower.

Write for complete information.

LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS

HYDRAULIC LATHE TRACER ATTACHMENT

LEADERS IN INDUSTRY MARK WITH NOBLEWEST

HEAVY DUTY ROLL-O-MARK

MULTI-PURPOSE METAL MARKING MACHINE

Noblewest's Roll-O-Mark with horn-style work holding fixture for marking the O.D. surface of large diameter rings.

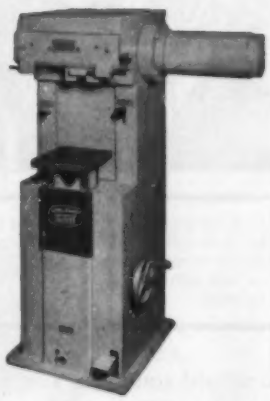
FEATURES

- *Extra large work capacity*
- *Greater versatility*
- *Marks, numbers, graduates, embosses*
- *Low operating cost*

Marking the surface of large diameter rings is just one of the many applications that are being done faster, better and at lower cost in many industries today with the new heavy duty all-pneumatic Roll-O-Mark. This one machine can be tooled for marking round or flat surfaces . . . precision graduating . . . serial numbering . . . knurling . . . and embossing. Whatever your needs for metal marking, Noblewest makes the machines, marking dies, and work-holding fixtures for doing the complete job. And remember, Noblewest Roll-Marking is *permanently indented* marking—*good for the life of your product.*

Write for new catalog. The Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Connecticut.

A few desirable territories open to qualified representatives.



All-pneumatic, Model 365 is the heavy duty version of the famous Model 50P1.

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

MARKING
NUMBERING
EMBOSSING
GRADUATING

Yet frame suppliers are still presenting elaborate engineering seminars on the merits of chassis-type cars." It seems that this statement contradicts your comments about secrecy.

If it were, in fact, well known that General Motors had such plans, then there would be, by definition, no secrecy involved. Surely you do not imply that these plans have only been kept secret from the supplier himself.

We consider that we are as well informed as anyone concerning design possibilities affecting the structural portions of the automobiles of the future. We think that we have a good understanding of the factors which might cause any given automobile manufacturer to adopt a body frame integral design or to use a separate, isolated, chassis frame.

Using our own experience as a guide, it would be my guess that the suppliers of other types of components are also rather well informed as to the circumstances which will affect the use of their special products. No doubt all of them recognize that they must continue to refine and modify their products to adapt them to the constantly changing wishes of the end users. This is the type of gamble that is inherent in any business, whether it be in the automotive industry or not. This doesn't frighten us, but it sure keeps us working.

I believe you'll agree that we have described a basically healthy business situation.

John R Parker, *director sales and engineering Automotive Division A O Smith Corp Milwaukee, Wis*

"Yes, the boss knows his picture is in the paper. That's where I'm heading for now!"

CALENDAR

Design Engineering Show, May 23-26, New York Coliseum, New York, NY.

American Supply & Machinery Manufacturers Association — Triple Industrial Supply Convention, May 23-25, Conrad Hilton Hotel, Chicago, Ill.

American Society for Quality Control — Annual Convention, May 24-26, Sheraton Palace Hotel, San Francisco, Calif.

Eastern Seaboard Apprenticeship Conference, May 24-27, Wentworth Hotel, New Castle, NH.

American Society of Mechanical Engineers — Semi-Annual Meeting & Aviation Conference, June 5-9, Statler Hilton Hotel, Dallas, Texas.

Society of Automotive Engineers —Summer Meeting, June 5-10, Edgewater Beach Hotel, Chicago, Ill.

Material Handling Institute—New England Show, June 6-8, Commonwealth Armory, Boston, Mass.

American Gear Manufacturers Association — Annual Convention June 6-8, The Homestead, Hot Springs, Va.

Joint International Powder Metallurgy Conference (MPIF & AIME)—June 13-15, Hotel Biltmore, New York, NY.

Drop Forging Association—Annual Meeting, June 26-29, Seigniory Club, Montebello, Quebec.

American Society for Testing Materials — Annual Meeting and Exhibit, June 26-July 1, Chalfonte-Haddon Hall, Atlantic City, NJ.

National Association of Metal Finishers—Annual Convention, July 22-24, Statler Hilton Hotel, Los Angeles, Calif.

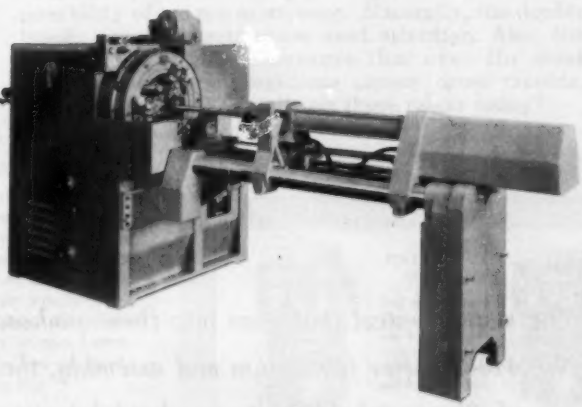
American Machine Tool Distributors Association—Annual Meeting, Sept 3-4, La Salle Hotel, Chicago, Ill.

National Machine Tool Builders Association—Machine Tool Exposition, Sept 6-16, International Amphitheatre, Chicago, Ill.

Reed 3-Cylindrical Die Machine

. . . produces splines faster with greater accuracy

Rolled Splines and Serrations are Smoother . . . Stronger . . . More Uniform



The Reed 3 cylindrical die method of generating accurate involute splines and serrations in seconds greatly reduces production costs.

The precise tracking of the 3 self-feeding dies cold forms the teeth with either 30° or 45° pressure angles. It gives greater tooth strength and better surface finish. The machine may be automated or equipped with a semi-automatic loading fixture.

MMT-PE

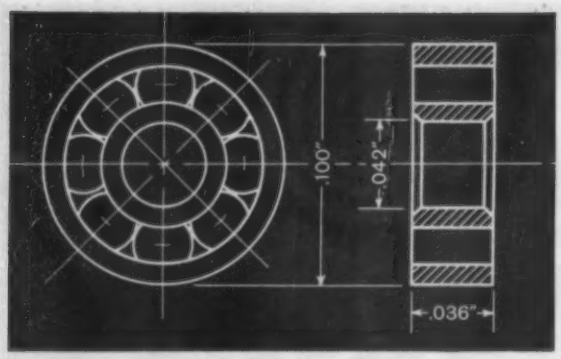
REED RID SM-175

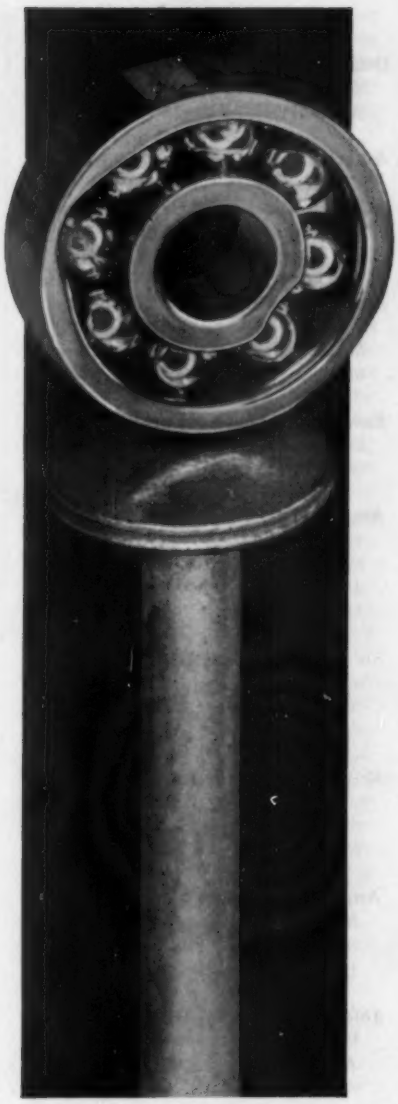
REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

HOLDEN, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto





the shortest distance between

these two points...

Carpenter stainless steel

The stainless steel that goes into these pinhead-size miniature bearings is Carpenter Mel-Trol No. 440-C. After fabrication and assembly, these bearings may be worth up to $130,000.00 per pound. There probably isn't a tougher fabricating job in the world today or a job where surface finish is so important. The performance of Carpenter stainless steel on spectacular jobs like this makes Carpenter's reputation, but it is the spectacular performance on ordinary jobs that keeps *it. Specifying Carpenter on your next stainless order will prove our reputation and bring new economies to your machining operation. The Carpenter Steel Company, Reading, Pa.*

Carpenter steel

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

NOTICE!

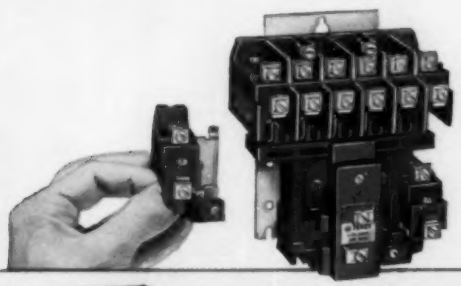
60 Second Contact Convertibility

ALLEN-BRADLEY CONTROL RELAYS

can thus easily be changed
from N.O. to N.C. (or vice versa)

Why not give yourself a real surprise! We refer to the ease with which you can convert the contacts of these Allen-Bradley Bulletin 700 Type BR control relays. Using only a screwdriver, contacts can be changed from normally open to normally closed (or vice versa) in seconds—without removing the relay from its mounting—or its wiring. This "on-the-spot" convertibility certainly suggests an appreciable moneysaving reduction in your relay inventories.

Extensive tests have proven conclusively that the Bulletin 700 Type BR relays are good for many—and we mean *many*—millions of trouble free operations. A "built-in" permanent air gap completely eliminates all possibility of magnetic sticking. Naturally, the double break, silver contacts never need attention. Also, the molded coil is your assurance that even the most severe atmospheric conditions cannot cause trouble. Please write for full details on these relays today!



BUT HEAR THIS!

In the event that when "on-the-job" it is discovered that something was either overlooked or added, the standard Bulletin 700 Type BR—either 2, 4, or 6 pole relay—can easily have added to its base, out in the field, either one or two switching poles. It is done as easily as "falling off a log."

General-Purpose
NEMA 1

Explosion-proof
NEMA 7

Waterproof
NEMA 4

FIVE RELAYS IN ONE
This shows how a Type BR relay can be arranged—in seconds—to do the job of five different relays.
3 N.C.—1 N.O.
3 N.O.—1 N.C.
4 N.C.
2 N.O.—2 N.C.
4 N.O.

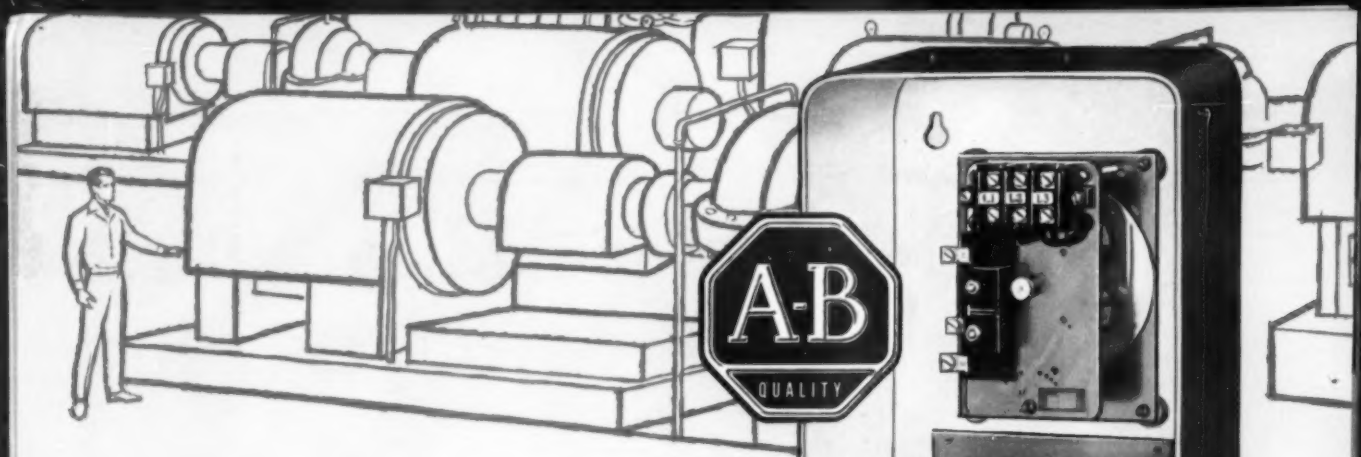
B-50-SM

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL



ALLEN-BRADLEY PHASE FAILURE *and* PHASE REVERSAL RELAYS

will provide positive protection for high-horsepower, high-priced motors!

It's sound "economy" to guard your investment in expensive motors and equipment against the extensive damage that can result from a phase failure or phase reversal. Allen-Bradley's Bulletin 812 Style RF relay provides *complete, positive* protection against both of these hazards.

The Bulletin 812 Style F phase failure relay instantly detects *all* open phase conditions on a motor branch circuit and removes the motor from the line—yet is not subject to nuisance dropouts from transient line fluctuations. An unusual feature of this Style F relay is its positive response, regardless of motor load or type of motor branch circuit employed.

The Bulletin 812 Style R phase reversal relay disconnects the motor from the line—whether it is running or not—when a phase reversal occurs on the line side of the relay. Thus, it can be used to protect a single motor or a group of motors. Furthermore, the Style R relay removes the motor from the line should a phase failure occur while the motor is stopped.

All A-B Bulletin 812 relays are completely "fail safe." It will pay you to investigate this economical insurance against the heavy losses that can—and *frequently* do—result from phase failure and phase reversal. Write today!

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Bulletin 812 Style RF for Phase Failure and Phase Reversal consists of Style F Phase Failure and Style R Phase Reversal relays in the same enclosure.

Bulletin 812 Style F for Phase Failure

Bulletin 812 Style R for Phase Reversal

B-8D-RH

ALLEN-BRADLEY

Member of NEMA

Quality Motor Control

SPOT NEWS...

- **Budd Co will lose $33-million contract** to build Thunderbird bodies with beginning of the 1961 model year, but has been awarded the contract to build the all-new bodies for the 1961 Continental and to produce major stampings for Ford's forthcoming compact trucks.

- **High-tin alloys that withstand temperatures above 4000 F** have been reported by Britain's Tin Research Institute. Instead of showing a lower melting point than either of their components, these alloys show a higher melting point. One tin-zirconium alloy melts above 4100 F. A similar compound containing titanium is brittle at room temperature and has to be made by powder metallurgy techniques.

- **Fiberglass can be spun like thread** to build up plastic shapes on steel forms. Lockheed is spinning electronically transparent radomes for West German F-104s on a rotating form tool that pulls the fiber through a resin bath. Final step is grinding to exact dimensions.

- **Chemical milling for mass production** will be studied under an R&D contract between Electric Typewriter Div of IBM (New York) and Chemical Milling International Corp, El Segundo, Calif. CMI also reports keen interest from automotive, architectural, petroleum, and general metalworking industries, as well as from aircraft and missile companies.

- **England, France, and West Germany** plan to jointly develop and produce military aircraft and missiles for NATO forces. Agreement involves two projects: VTOL aircraft for NATO requirements and electronic equipment for European air defense. Missile development is said to have been discussed, but this was not confirmed—or denied.

> **Special recognition "for outstanding journalism"** *has just been given the exclusive report in this magazine on the study of Army production equipment made by the Operations Research Office of Johns Hopkins. Burnham Finney has received a Jesse H Neal Award of Merit for his article "Can We Prevent A Production Pearl Harbor?"* (*AM*—Jul 27 '59, p89).

- **The Davy Crockett,** the Army's newest man-portable recoilless gun, marks the first major application of titanium for infantry use. Heat-treated-titanium weapon weighs 80 lb less than conventional unit. Capable of firing atomic shells, these weapons will require about 2-million pounds of titanium over the next five years.

- **Russians are using electropolishing** to finish metal cutting tools. The electrolytic processing removes the surface skin of deformed metal, containing a high proportion of soft, poorly conducting austenite, without etching. Close control over depth of metal removal can be assured, and the resulting surface finish is high.

- **Chrysler Corp, despite underbidding by $20 million,** lost the $65-million contract to build airframes for the second stage of the Saturn space vehicle. Michigan congressmen are protesting vigorously because loss jeopardizes 9000 jobs at Chrysler's Detroit missile plant.

- **A metal forging plant** with an annual capacity of 2500 tons of forgings has been approved by the Israeli Ministry of Trade and Industry. Investment will amount to about $1.2 million. Plant, when built, will be government owned, but at a later date will be sold to private investors.

CIRCLE 217 READER SERVICE CARD

IMMEDIATE DELIVERY

STYLE 28-A
HYDRAULIC POWER UNIT

STYLE 22
HYDRAULIC POWER UNIT

STYLE 20
HYDRAULIC POWER UNIT

STYLE 502
LEAD SCREW TAPPING UNIT

Ex-Cell-O Hydraulic Power Units in Stock Now to Cut Your Machine Tool Lead Time and Production Costs!

Reduce lead time, increase productivity, and cut per-unit cost with Ex-Cell-O Quill-Type Hydraulic Power Units—immediately available for drilling, counterboring, spot-facing, and reaming operations, or as prime movers for milling equipment.

Ex-Cell-O Hydraulic Power Units are self-lubricated . . . built for easy installation, and trouble-free operation, even under fast cycles and continuous production. Compactness allows close center distance installation, in-line or radial . . . versatility makes them ideally suited for special-purpose, high production machines. A companion product, the Style 502 Tapping Unit, uses a lead screw for trouble-free tapping.

See your Ex-Cell-O representative or write direct for full information on the complete line of Hydraulic Power Units and our Canadian-built Lead Screw Tapping Unit.

EX-CELL-O FOR PRECISION

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • ATOMIC ENERGY EQUIPMENT • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

60-42

WASHINGTON...

Defense procurement cut . . .

The House Appropriations Committee has made a cut of $400 million in over-all Pentagon procurement funds in the coming fiscal year. The swipe was designed to stimulate "more economical procurement practices."

If the cut sticks, the Pentagon will have to apply the saving across the board by trimming pricing and cost estimates in individual contracts and tightening up on policing of procurement.

The Committee rapped the Pentagon for failure to formulate realistic plans and specifications which would allow maximum use of competitive bidding. It also criticized failure to follow up the General Accounting Office's recommendations to tighten up on procurement policies.

The report cites cases of 24 to 41% profits-to-costs ratios on Army Nike missile subcontracts, $3-million overcharges on an Air Force contract for fire control radar, and several instances where the services were able to buy equipment significantly cheaper through advertised procurement rather than negotiated contracting.

The total defense budget was boosted $122 million by the Committee to $39.3 billion.

Soviet competition . . .

Greater efficiency in the domestic machine tool industry is the key to competition with the Soviet Union. This was the theme of speakers at a Washington meeting of five unions reviewing the economics of the industry in preparation for bargaining sessions.

Prof Seymour Melman (Columbia Univ.), who toured Soviet machine tool factories last year, said the industry there is highly mechanized. Mechanization, rather than low labor costs, will permit the Soviet to challenge U S superiority.

The professor scored the "handicraft system" that he said dominates the U S industry. He told union members not to worry about losing jobs through automation. A more efficient industry will mean broader markets at home and abroad.

An AFL-CIO study cited good industry profits in the postwar years, precluding any need for labor to "subsidize" industry by holding the wage line in "the fat years."

The "munitions lobby" . . .

"Controversial" advertising by military contractors would be severely censored by a Defense Dept proposal. The proposed rules have kicked up a rumpus.

They would go far beyond current security restrictions and bar "inappropriate claims" about new weapons, discussion of the economic impact of contract awards or cutbacks, etc. The move is sparked by President Eisenhower's press conference attack on the "munitions lobby" and the Hebert Committee's (House Armed Services) recommendations that the Pentagon clamp down.

But Rep John Moss (D-Calif), chief Congressional spokesman on freedom of information, cries "censorship." He sees the move as making Asst Defense Secretary Murray Snyder an "advertising czar."

Differs with Rickover . . .

Vice Admiral R B Pirie takes issue with Vice Admiral Rickover on the atomic-powered aircraft carrier. Rickover claimed that a conventionally-powered carrier would be obsolete. The House Appropriations Committee cut the carrier out. Now the Navy is working on the Senate to restore it.

Pirie, the Navy's top airman, pooh-poohs operational advantages of the A-powered carrier, says they will not offset the extra $130-million cost. He says a conventionally-powered carrier would be fast enough to handle new navy aircraft.

Patent relief over-rated . . .

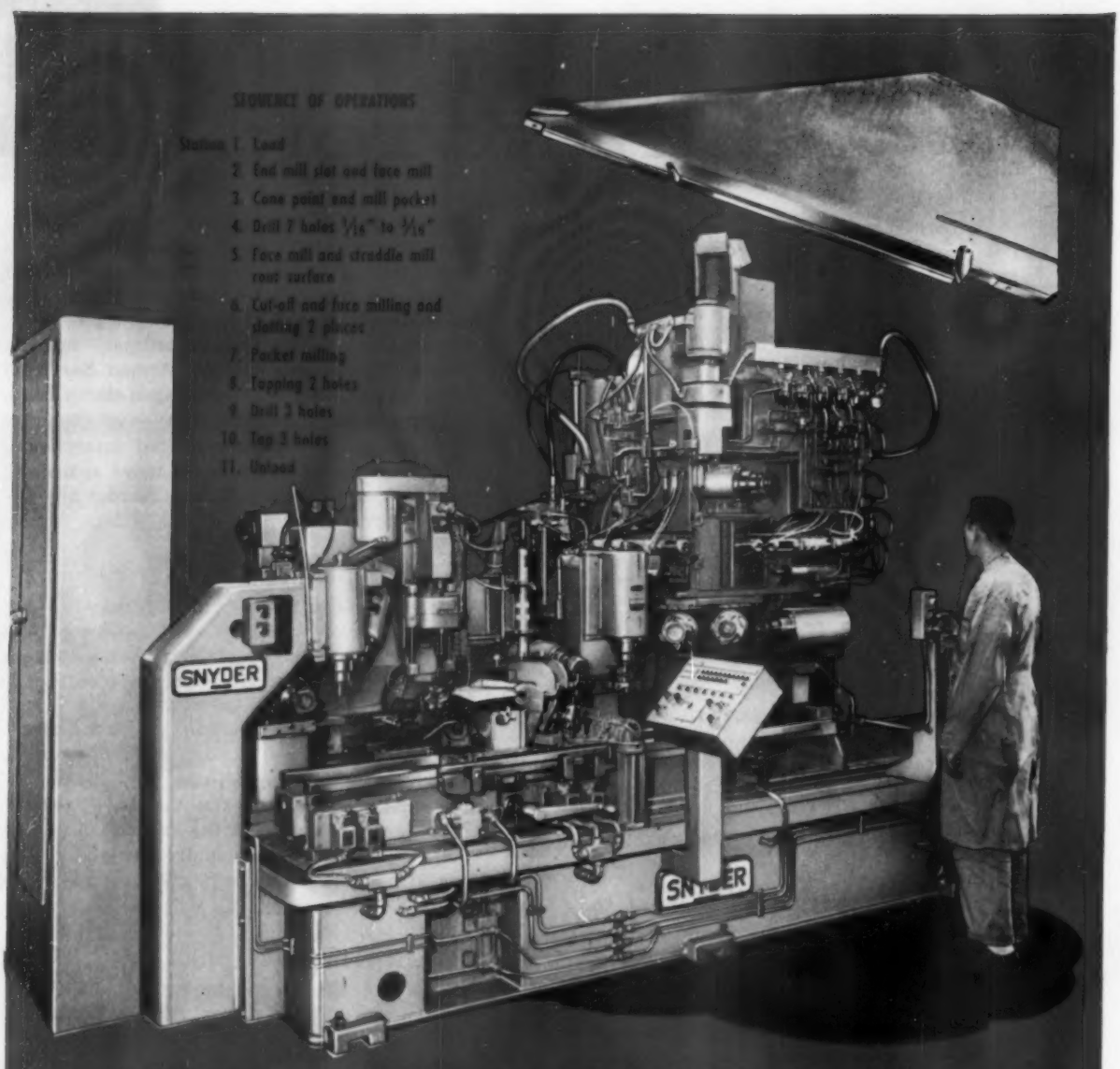
Compulsory licensing of patents is a much over-rated form of relief in antitrust cases, says a unique new study by the Senate Patents Subcommittee.

A survey of 81 antitrust cases in recent years shows that only in eight did compulsory licensing stimulate effective competition. In 31 cases, no patents were even sought by would-be competitors. And in most cases where patent rights were granted they did not prove to be particularly useful.

Priority ratings . . .

Defense suppliers now must use a priority rating symbol on all orders they place for materials and components to fill contracts for military, space, and atomic projects.

Up to now, defense contractors have been required to use such symbols on their orders only when so-called controlled materials are involved —copper, steel, aluminum, and nickel alloys. Now defense suppliers must place the proper symbol on their orders even if, for instance, it's a plastic, lumber or textile item.


SEQUENCE OF OPERATIONS
Station 1. Load
2. End mill slot and face mill
3. Cone point and mill pocket
4. Drill 7 holes 1/16" to 1/16"
5. Face mill and straddle mill rout surfaces
6. Cut-off and face milling and slotting 2 places
7. Pocket milling
8. Tapping 2 holes
9. Drill 3 holes
10. Tap 3 holes
11. Unload
SNYDER
SNYDER

COMPLEX MISSILE WING GETS 24 PRECISION OPERATIONS IN SPECIAL SNYDER PROGRAMMING TOOL

at Martin Company's Baltimore Division

Production rate, tolerances and part configuration dictated the fundamental design concept of this exceptionally compact tool which has 11 stations and performs 24 operations.

The cycle can be automatic, semi-automatic or manual. Controls for multiple cycle operations are provided by utilizing basic circuits triggered by a programming control device.

SNYDER
CORPORATION
(Formerly Snyder Tool & Engineering Company)

3400 E. LAFAYETTE—DETROIT 7, MICHIGAN
Phone: LO 7-0123

DETROIT...

Profits too high?

Back in January 1958, Estes Kefauver raked the auto industry over the Senatorial coals for its policy of "administered pricing." Although no collusion was charged, his committee plainly felt that a leader (namely GM) set prices and other companies merely followed the pattern.

Costly weeks went by (Chrysler alone figures it spent $500,000 in expense accounts, manhours and materials on the hearings) without changing Kefauver's conviction that the auto industry makes too much money, is too inflexible, and that it ought to go into the market place with its cars on a supply and demand basis.

At no time during the hearings, try as he might, was Kefauver able to get much costing information on any car. His report on the hearings made it plain that he didn't realize that auto costing is a painstakingly detailed process—one that for all practical purposes is firmed long before the car gets into production.

The facts...

Ford's Falcon, for example, was originally costed by its planners at $1383—based on an average of body styles, and on the expectation of selling 275,000 units a year for three years (before the first changes in such major components as the body shell and engine would come). Months later, when the Falcon went into production, this figure (which automakers call "Financial Planning Volume") had increased by only $16.

Based on an average anticipated selling price to the dealer of $1546, Ford Division fixed its sights months back on a net average profit per car of $163. This does not seem excessive—nor does the parent Ford Motor Co's expectation of $253 a unit, which of course includes the Ford Division profit. Even the latter figure is considerably less than the mark-up enjoyed by the dealer.

The higher profit for the parent company is due to intra-company sale of such manufactured components as transmissions. By subtracting the Ford Division profit from the Ford Motor Co profit, you can see that $90 profit is divided among the manufacturing divisions.

Cost breakdown...

Of the $1209 variable costs in the manufacture of a Falcon, by far the largest share, $994, goes for materials and components. Direct labor costs of $58 per unit indicate that surprisingly few manhours are needed to assemble the vehicle.

Some of the other items included among Falcon variables: transportation in and out $79, manufacturing overhead $35, advertising $24, and warranty $17.

Fixed costs total $174 per car, including amortization of tools and facilities—a substantial part of the $100 million bill for bringing the Falcon to market.

Vice President George Walker's Styling Department can take pride in its miniscule charge of $2 per car: By contrast, engineering cost 10 times as much. Tooling supplied to vendors cost $8, and fanfare of introducing the car $6.

Put into perspective...

. . . three things become apparent. First, Ford cannot be fairly accused of greediness. A 10.6% mark-up is not much return on a $100-million gamble. Small loan companies often charge more for money, with a lot less risk.

Second, the timing involved in arriving at Financial Planning Volume indicates that there can hardly be collusion between automakers in setting prices. On-the-surface similarity among car prices results from this: One 3000-lb car takes about as many dollars worth of materials and manhours as another. And it must be remembered that these are the two major cost items in any car.

In any case, Financial Planning Volume is established by a company *before* a car goes on sale—and only the market place can prove whether the FPV is right or wrong.

Third, everything is predicated on reaching the financial volume. As to the Falcon, sales are humming along at a merry rate well above this volume. In other words, Ford is making more money than it anticipated on each Falcon.

But what about Ford Motor Co's other products? FPV for the standard-sized Ford, for example, is pegged at 1-million units—and production since the start of the year is already off 143,000 units, compared to the same period in 1959. Falcon's success may account for a considerable portion of this loss, thus stealing sales from a car that returns about 30% more profit.

Like every auto company, Ford has misjudged the market on occasion. It sank $300 million into the Edsel over three model years and never even came close to reaching financial volume. The same thing happened with the Continental of 1956 and 1957. Today, the same circumstances surround Lincoln and Mercury operations—**Don MacDonald.**

If what you make is round or square or odd shaped

If you make it one at a time or by the millions

If you want to check its OD or its ID or a whole

lot of dimensions at once ...and if you want

the gage to indicate a dimension or flash a light

or ring a bell or

a machine on the basis of tolerances

down to thousandths .001 or millionths .000001

SHEFFIELD can recommend the exact type of

Air, Electric, Electronic, Visual or Limit gages you need...

or a complete automatic gaging or assembly machine or system...

with dimensional quality control based on the

ultimate standard of gagemaking: **INTEGRITY**

The
SHEFFIELD
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A subsidiary of the Bendix Aviation Corporation

Gages, Measuring Instruments, Automatic Gaging & Assembly Systems • Machine Tools • Contract Mfg.

AIRCRAFT and MISSILES... TRENDS

More planes, less variety . . .

Overall military procurement of manned aircraft is being scaled down, but the Army has laid out plans for a big increase in buying over the next decade. The program calls for boosting the Army's inventory from 5500 planes to 8000 new aircraft by 1970. Emphasis will be on trimming the variety—from 15 different types now in operation to eight.

A new turbine-powered, light-observation helicopter will replace the L-19 fixed-wing plane and the H-13 and H-23 observation helicopters (*AM/MM*—May 2 '60, p 81).

A new utility-tactical transport helicopter will also be bought to replace the L-20, H-19, H-34, and H-21.

Other new production orders will be placed for the Grumman AO-1 Mohawk medium observation plane (a twin-turbined, STOL type); the DeHavilland Caribou AC-1 transport (a twin-engine STOL plane which can carry three tons); and the twin-turbine HC-1B Chinook VTOL helicopter. At least 300 each of the last two types will be bought.

Atlas, Titan improved . . .

A new version of the Atlas will have a range up to 8000 statute miles, compared to 7000 in the earlier missile. The new model will be all-inertially guided and capable of salvo launchings. The first Atlas units are radio-guided, can be fired only one by one.

Titan's range is being boosted from 8000 to 9800 miles with a bigger second engine. The new model will have storable liquid fuels instead of cryogenic types, and will have almost instantaneous reaction time. All-inertial guidance will also allow for salvo launchings. For Titan this will mean firing from underground silos.

A new heavy heat-sink type re-entry nose cone to replace the ablative type will allow both missiles to carry heavy nuclear payloads.

Convair, Air Force criticized . . .

A report by the General Accounting Office sharply criticizes both the Air Force and General Dynamic's Convair division for decision to make air conditioning units for B-58's instead of farming out the job or adapting existing equipment.

Report puts the cost to the US Government of this decision at $2.6 million. It recommends closer Pentagon control over decisions by prime contractors on whether to make or buy accessory items.

Convair decided to make air conditioning carts (which are rolled up to the plane to keep it cool while on the ground when built-in coolers aren't working). Convair did not invite bids, although the company had no previous experience in making this equipment.

GAO also charges that both parties should have recognized earlier in the game that standard air-cooling carts could be adapted to B-58's. Eventually this was done.

Convair protests that it's always easier to quarterback the game on Monday morning.

Airborne command post...

SAC is modifying three Boeing KC-135 jet tanker planes into airborne command-post craft. The planes will be ready to fly on 15-minute notice. They will be equipped to take over SAC's global operations in case the Omaha base and alternative SAC command posts on the ground are ever knocked out. The three planes are being converted at Tinker AFB, Oklahoma City.

West Coast outlook . . .

Southern California's aircraft industry continues its gradual but irrevocable decline. Aircraft employment declined by 2500 in March. The most recent total of 163,300 jobs in the industry represents a reduction of 14,500 during the past six months.

Missile business, on the other hand, presents a much brighter picture. Employment is up 9700 from a year ago. In addition, Douglas Aircraft recently won the NASA competition to develop and produce airframes for the S-4 upper stage for Saturn space vehicles. Initial contract will call for nine stages and will run to more than $65 million.

Douglas will use its Thor missile team and build the stages at its Santa Monica plant.

Controlled rocket thrust . . .

North American's Rocketdyne Division, McGregor, Texas, has designed a controllable nozzle that effectively varies the thrust of a solid-propellant motor 70%. In current solid-propellant rockets, thrust is constant from ignition to burnout.

Rocketdyne engineers believe they can achieve even greater thrust variation by using a propellant with greater pressure sensitivity than that used in their development program.

HARDINGE
ELMIRA, N.Y.

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INCREASE PRODUCTION

ON AUTOMATIC SCREW MACHINES

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Pads Cannot Work Loose
No Screws—No Pins

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Cleveland — Cone — Davenport — Greenlee
Gridley and Acme-Gridley — National Acme
New Britain — Warner & Swasey

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MASTER COLLETS and PADS

The Only MASTER COLLET with
No Work Pressure On The Screw

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Greenlee — Gridley and Acme-Gridley
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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

MACHINE TOOLS...

GM to tool in Argentina...

General Motors is getting ready to spend at least $11 million on machine tools for a truck engine in Argentina. The truck will be of Vauxhall (British GM subsidiary) design. This is said to be the first time that General Motors has ever put into production a European-designed vehicle elsewhere than in Europe.

In tooling for this job General Motors would like to duplicate equipment now installed at the Vauxhall plant in England. Much of Vauxhall's machinery is of British origin and therefore British machine tools, in the main, probably will be purchased and some German.

The trouble is that British builders are quoting deliveries of as long as a year-and-a-half. Despite this fact, British builders stand a good chance of getting a substantial share of the business. However, U S and German builders should receive sizable orders.

This General Motors project in Argentina is on top of Ford's program for a new engine there. In addition, Kaiser's Argentina company is adding to its line a passenger car with a jeep engine and frame and an Alfa Romeo body, a bid for the "smart-car" trade. Kaiser also is about to begin manufacture in Argentina of the Renault Dauphine.

Builders criticized...

One high Detroit automobile official says privately that the U S machine tool industry has not been as aggressive as it might be in competing for Latin-American business, much of which is going not only to west European builders but also to the Czechs. This official is aiming at dealing directly with U S builders through their Detroit direct sales offices or their Detroit distributors instead of through intermediary selling organizations.

Vauxhall and Opel to expand...

Vauxhall and the German GM subsidiary Opel have in mind spending around $175 million to expand their manufacturing facilities in the next two years. This sum, it is said, will be invested in production equipment and its tooling.

This program will represent a third major round of expansion during little more than a ten-year period. The first round was in the early 1950s, the second in 1956-58, and the third will be in 1960-62.

There is concern within automotive circles that the European motor car industry may be heading into a period of over-expansion. When the various British car-production projects are completed, the British industry will have a capacity of almost 2¼ million cars. The British Motor Corp alone will be able to make 1-million units a year. In 1959 not many more than 1-million cars were turned out by the entire British automobile industry.

Ford to add to European capacity...

Ford's European companies (in England, Germany and the Netherlands) expect to make an outlay of around $200 million in the next two years. This money will go for production equipment of all kinds, including materials-handling and other processing equipment for assembly plants. But most of the spending will be for machine tools and related machinery.

A prominent U S company long identified with the automotive industry is supplying all the body dies, jigs and fixtures for making all the sheet-metal parts of a new European car, said to be of French origin. The design is reported to be simple by U S standards, with low production costs as a result.

Ford to spend large sums...

Though no spectacular new programs are in sight, Detroit is expected to be the source of important orders for machine tools and other production equipment this year.

Ford, for one, is looking for ways and means to get its production costs down. It will be making purchases from time to time that for the entire year 1960 are likely to add up to as much as $70 million.

The Ford people are believed to feel that their production equipment, in general, is in better shape than that of General Motors. A larger ratio of Ford's machine tool holdings were bought within the past ten years. Ford incidentally, is hammering away on a campaign to secure a better-quality product and is spending large sums for this purpose.

Ford is pouring out a considerable amount for a new steel rolling mill at Rouge that will add to its steel-making capacity but mainly will improve the quality of Ford steel.

BF

(An Industrial Revolution In One Easy Lesson)

This is the Friden Flexowriter: a heavy-duty, automatic electric typewriter, with an integral tape punch and tape reader. There is no faster, easier or better device for coding paper tapes. Here's why:

1) The keyboard is standard; any competent typist can master the other controls in less than an hour.
2) The operator types a visual proof as she makes the tape; errors are caught and corrected immediately.
3) Automatic parity check guarantees against mis-coding.
4) Tapes can be double-checked (or quickly duplicated) by running them through the reader.

For all these reasons, the great majority of machine tool manufacturers either *have standardized* or *are now standardizing* on the Friden tape reader with Flexowriter input. Take it from the pioneers in numerical control: punched paper tape is the best input; and in punched paper tape, Friden is by far the leader.

In business, communications, graphic arts, and now in heavy industry, Friden source data systems build a new concept. We call it PRACTIMATION: automation so hand-in-hand with practicality there can be no other word for it. ©1960 FRIDEN, INC.

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MATERIALS...

American Plastics Institute...

An independent committee, whose members have been drawn from all segments of the plastics industry, has for four years been working out detailed plans for an American Plastics Institute. The proposed organization would be concerned with both the industry's immediate problems and the assurance of its future health and growth.

Primarily, the institute would fulfill the need for long-range basic research into the nature and characteristics of plastic materials. It would investigate other significant aspects of the science and engineering of plastics and would disseminate the findings of this research to all levels of plastics production, processing, and end use.

Education—at the graduate-school level—would also be a major concern of the institute. Its program would encourage the large numbers of qualified plastics engineers and chemists needed by the mushrooming industry. To serve this purpose, it is hoped that the institute can be established at one of the nation's leading educational institutions—still to be selected. Representatives from every segment of the plastics industry—materials producers, equipment manufacturers, custom molders, and two major consuming industries (electronics and appliances) —have met in New York. They expressed the need for such an institute and described how it would benefit their own companies and firms like them. In no way a "trade association," the institute would serve all phases and levels of the plastics industry.

Government-agency support for the work of the proposed Plastics Institute was promised by Dr Gordon M Kline, chief of the division on fibrous and organic materials of the US Bureau of Standards, in Washington. Chief executives and research directors of all firms in the industry will be asked to support and participate in the activities of the institute.

Professor Louis F Rahm, professor of mechanical engineering at Princeton University, and director of its Plastics Laboratory, is serving as chairman of the organizational committee.

Something in common...

Diamonds . . . nerves . . . electric eels! At first glance they don't seem to have much relationship to each other. But there is one common denominator. Each involves organic semi-conductors capable of transmitting, modifying or modulating electric current. Researchers at Battelle Memorial Institute and other laboratories tell us that this common characteristic may provide many new answers to old questions; perhaps even an important breakthrough in our understanding of the life process.

Thin tin...

A new process produces tinplate about half the thickness of anything now used in canmaking. Details of the process are secret until patent protection is obtained. Meanwhile, can manufacturers are experimenting with the thinner tinplate to determine where it can be used to best advantage. They must modify, rather than replace, present production equipment.

Base-box weights of new material are 40 to 60 lb each. (A base box is a unit of measure containing 31,360 sq in., or 217.78 sq ft, of tinplate. Can makers purchase it on a surface area basis.) Most tinplate now used by can producers is in the 75 to 100 lb base-box weight range.

Tin thickness is the same on the new material as on conventional heavier tinplate. Only the thickness of the steel is reduced. In addition to food cans, the lighter tinplate might be used in making disposable baking pans, detergent cans, paint cans, frozen-dinner trays, and for packaging hard goods or clothing.

Physical characteristics of this tinplate are said to be distinctly different from the heavier form now in use. The new product has additional strength and rigidity. It will be merchandised in coils but still sold by surface area. While it is technically possible to go to even thinner gages, present markets don't indicate commercial demand for this material. In time, even foil might be produced. The new material will be tested in non-process food (foods not pressure-cooked in the can) areas first.

Roger M Blough, United States Steel Board Chairman, told the National Canners Association Convention in Miami that the new tinplate was one of the ways his company was meeting competition from other materials in the canning industry.

Immediate savings to the can producer and the canner include reduced shipping weight, ability to seal by soldering and the continued use of magnetic handling. There may be a saving in material cost but it is too early to know what the cost will be. Pilot plant operations and field testing are sufficient to show that there are no major roadblocks. Now US Steel is trying to determine and prove the markets. Once known, large-scale production will be installed.

Courtesy Solar Aircraft Company

Solar Aircraft uses Gilbert radials to produce close-tolerance holes

This operator at Solar Aircraft Company, San Diego, Calif., is drilling and tapping 57 holes to .001" tolerances in an afterburner housing for the J65 turbojet engine.

Several features make his work productive and accurate. Speed and feed shifters are direct-reading. Gears are counter-balanced for easy shifting. Four-lever turnstile is always within easy reach. The operator can see the spindle easily, as shown here.

This Gilbert radial is one of four at Solar—proof that you're in solid company when you acquire one of these fine machines.

Our representative will gladly give you the profitable details. Get a quotation now.

The Cincinnati Gilbert Machine Tool Co., 3340 Beekman St., Cincinnati 23, Ohio.

Write for free bulletin

GILBERT

WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking is waiting for the upswing...

Metalworking production has been holding steady for the past three months, but some segments are still waiting for the boom that the anticipated increase in capital spending has promised.

Steel production continues to drop off, and will probably go even lower. But this slowing down is considered a healthy thing, because it will bring the operating rate closer to the rate of consumption. It could still be a record year, and with little danger of piling up new inventories.

Small integral and fractional-hp motor makers are optimistic for the year as a whole and report good business now. One major Cleveland firm reports first-three-months sales up 25% over 1959. February and March orders set all-time records for this company.

The welding shops are still looking for the boom. Although they report an increased rate of inquiries, only in the last few weeks have these turned into some orders. Most shops expected a pickup early in the fourth quarter. Employment is steady.

Fastener manufacturers report sales off and down. "Fasteners work on an every-other-year basis—'59 was good, so we don't expect an especially good '60," said a spokesman for one major manufacturer. The Industrial Fastener Index of Shipments dropped eight points in the latest month.

Cutting tool manufacturers in the midwest offer mixed reports. Several companies report business up 5, 10, 15% above last year; another says business dropped in April. Price increases are expected in the next couple of months.

Farm and construction machinery business is picking up after a slow start brought on by bad weather. Only one major manufacturer feels that 1960 business will be under that of 1959.

Gage and precision tool producers report that business is good and on the upswing. Even the one dissenter expects his 1960 business will be about 3% better than 1959.

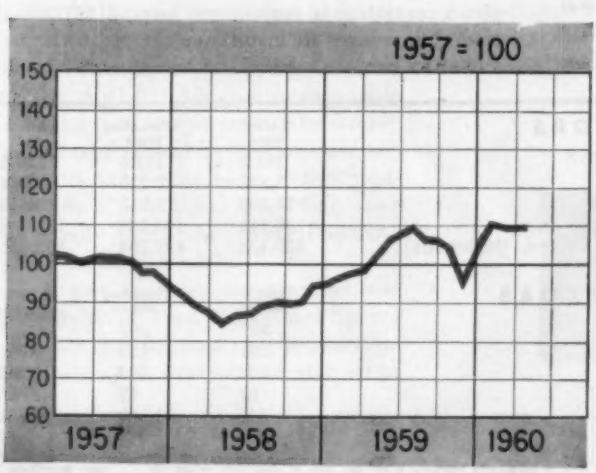
Plating shops in the Chicago area give conflicting reports. Two report business up more than 10% over 1959; another says business is down 15 to 20%, but that the remainder of 1960 looks promising. There may be price increases after the summer, said one plater.

Despite reduced production schedules, one major bearing manufacturer continues to predict a good level of business throughout 1960. Company expects its railroad bearing business to have the best quarter in its history during the second quarter of this year, thanks to the mount-roller freight.

Tool and die business on the West Coast is slow. A few scattered shops are still on overtime, but most firms report business is scarce, and will remain so in the foreseeable future. Chief reason is the decline of the airframe industry.

Stamping business, as reflected in figures from the Pressed Metal Institute, continues on the upswing. Outlook for the year is pegged at about equal to 1957, one of the stampers' best years.

Shipbuilding in the San Francisco area holds no promise of improvement. Employment is down 30% from normal, will be down 60% by end of the year.



108

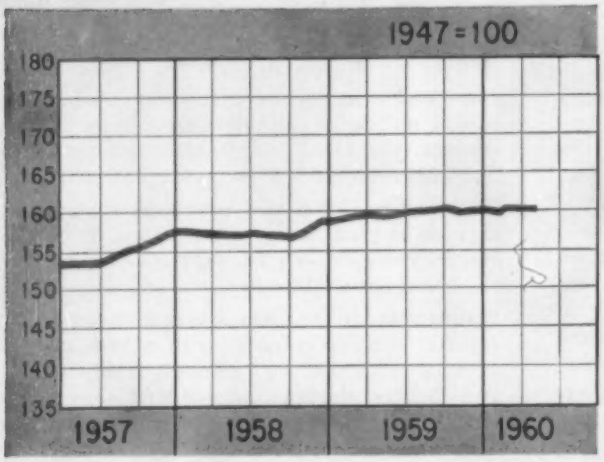
AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	APR. Estimated	MAR. Preliminary	FEB. Revised	MAR. Year Ago
Total Index	**108**	**108**	**108**	**98**
Machinery	105	104		93
Electrical Machinery	115	115		100
Autos	120	126		103
Other Transportation	87	88		94
Other Metalworking .	111	111		102

◀ CIRCLE 223 READER SERVICE CARD

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	APR. Estimated	MAR Preliminary	FEB. Revised	MAR. Year Ago
Total Index	**159.8**	**159.8**	**159.8**	**158.5**
Metalworking Machinery	**190.4**	**189.7**		**183.8**
Other Machinery exc. Electrical	**172.8**	**172.8**		**169.8**
Electrical Machinery	**162.3**	**162.4**		**159.4**
Fabricated Metal Products	**148.0**	**148.0**		**148.7**

Consumer credit in the months ahead . . .

The amount of consumer installment debt outstanding increased by $400 million during March, the third straight month in which an increase of that size was registered. At its March pace, consumer debt was increasing more rapidly than in the final quarter of 1959, but slower than in the peak months of last year. The behavior of consumer installment credit in the months ahead will have an important bearing on sales of autos and other major consumer durable goods which are purchased largely on credit.

The drop in consumer borrowing late last year reflected in part the scarcities of autos that developed as the steel strike dragged on. More recently retail sales of durables—including autos, which account for a big part of consumer installment buying—had been slowed by the weather.

Aside from these factors, however, consumer installment buying was destined to grow more slowly this year than it did in 1959, when total installment credit outstanding rose by 16%.

One reason why installment debt increased so rapidly last year was that consumers entered 1959 relatively debt-free. Installment buying fell substantially during 1958 and consumers were able to pay off some of their outstanding debt. Free from old debt, they were able to make new purchases. Since early 1959, however, installment payments have been growing faster than disposable income. Payments on installment purchases are now taking more than 13% of consumer income—a higher proportion than during most of the postwar period. So we can expect some reduction in the rate at which consumers pile up installment debt in the months ahead.

This doesn't mean that installment buying will fall off and crimp sales of durables. Incomes are growing and will permit consumers to repay bigger debt than they now carry. But until consumers have widened the margin between their incomes and their debt payments we can't expect a real surge in installment buying. But even modest increases in installment buying will be a healthy prop to business in the months ahead.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	151.3	151.5	150.4
Steel ingot production (thousand tons)	2,132	2,210	2,604
Electric power output (million Kilowatt hours)	13,300	13,213	12,546
Production of automobiles and trucks	138,311	144,886	118,059
Engineering construction awards (Eng. News-Record, thousands)	530,424	493,104	403,255

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	302	267	306
Vacuuum cleaners sales (thousands of units)	294	258	271
Washers sales (thousands of units)	222	203	298
Household electric ranges (thousands of units)	84	67	86
Radio production (thousands of units)	845	1,353	1,125
Television production (thousands of units)	503	525	459
Gear sales index (1947-49=100)	278.6	243.4	199.9
Foundry equipment new orders index (shipments, 1947-49=100)	128.6	95.5	237.1

*Seasonally adjusted

HOW MUCH COULD YOUR SHOP PRODUCE *IN A TWO HOUR DAY...*

...*LESS* A COFFEE BREAK?

MMT=PE

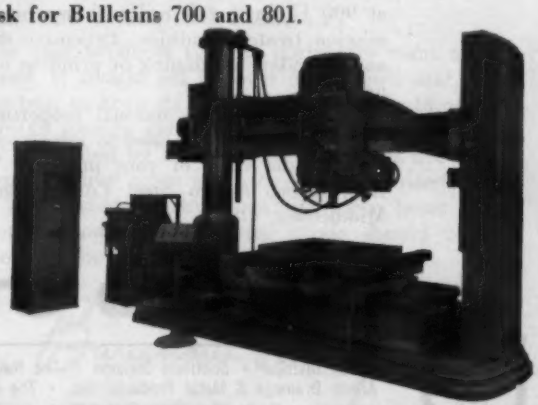
Almost as much as you now produce in 8 hours with conventional equipment! When you switch to an AMERICAN numerically controlled Positioning Table and the new AMERICAN Hole Wizard Radial Drill, your production will step up 400%!

In addition to fast, error-proof positioning to ± .000250", the AMERICAN positioning table gives you extreme ease of operation. The simply loaded punched tape is read by low pressure air, and automatically moves the table to first position at the touch of a button. After that, your operator need only touch the "Next Position" button on the portable console.

This rugged, profit-making combination was designed by American Tool Works and Sperry Gyroscope engineers to increase your production, eliminate expensive jigs, prevent operator error.

Ask your American Distributor about "Toolease," our leasing plan under which this AMERICAN Positioning Table and AMERICAN Hole Wizard Radial combination can improve your production... while it pays for itself. Or, write Section 163 at the address below.

Ask for Bulletins 700 and 801.



THE AMERICAN TOOL WORKS COMPANY

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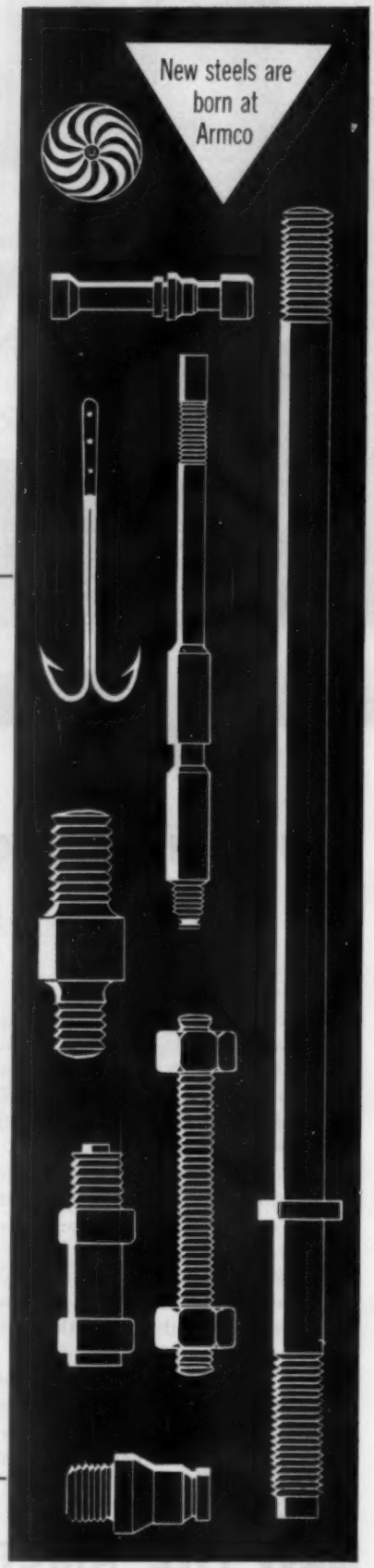
CIRCLE 224 READER SERVICE CARD

Armco 17-4 PH Stainless Offers You 7 Big Advantages

Combines High Strength; Resistance to Corrosion, Galling, Abrasion, Fatigue, Heat; Simplifies Production



Armco 17-4 PH gives you this array of advantages because it has such an unusual combination of mechanical properties, corrosion resistance, and fabricating characteristics. Here are a few that have made this special Armco stainless steel useful in so many applications:

Ultimate tensile strength—200,000 psi*
Tensile yield strength—185,000 psi*
Elongation, % in 2 in.—14*
Hardness, Rockwell—C44*
Endurance limit, 10^4 cycles—90,000 psi*
Short time ten. yld. str. at 800 F—141,000 psi*
Corrosion resistance—Equal to Type 302 Stainless in most media
Heat treatment—1 hour at 900 F for highest strength and hardness

*Typical properties in Condition H 900

Armco 17-4 PH has been the answer to perplexing design problems in a diverse range of applications such as fishhooks, surgical tools, missiles, shoe machinery, valves and atomic reactors. It has replaced carbon steels, austenitic and martensitic stainless steels, and non-ferrous alloys because it gives better performance and frequently lowers production costs.

Because 17-4 PH stainless can be heat treated by only 1 hour at 900 F, parts can be finish machined in the easy-to-work solution treated condition. Expensive descaling, straightening, and secondary machining or grinding operations can be eliminated.

Consider how the unusual properties of Armco 17-4 PH Stainless Steel can be used to solve your design problems and improve the value of your products. Write us for complete information. Armco Steel Corporation, 1870 Curtis Street, Middletown, Ohio.

ARMCO STEEL

Armco Division • Sheffield Division • The National Supply Company
Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation

American Machinist / Metalworking Manufacturing ESTABLISHED 1877

The Impact of the Compact

The compact has made a big impact. Whereas a year ago only the Rambler and the Lark were competing against small foreign cars, today the Falcon and the Corvair and the Valiant have joined them and are doing so well that Detroit is agog and European makers are not as happy as they were.

Once the automotive high command was convinced that it had to do something to stop imports from taking a larger and larger slice of the U S passenger car market, the unfavorable trend of car business was reversed. Detroit now is giving the public what it wants. And the public is buying. Sales of compact cars probably will get up to 1.7 million during the 1960 model year.

That is not the end of it. More compacts are to be put on the market by other automobile companies in the 1961 model season. It is a safe guess that U S-made compacts will sell in even higher volume next year than this year.

If foreign "small" small cars . . .

continue to be successful in this country, you can be certain that Detroit no longer intends to sit idly by and do nothing about it, for Detroit has learned its lesson the hard way. It will have ready "compact" compacts in direct competition.

The automotive moguls finally have acknowledged the sorrowful fact that a car no longer is the only prestige symbol in the life of an American. He now wants elaborate vacations, a modernistic house and furnishings, perhaps a boat and other things that make living enjoyable. So Detroit has bowed to the inevitable, is offering more economical transportation, and is recovering its market nicely.

The automobile industry's flip-flop is the most spectacular performance of all in meeting foreign competition and in giving the buyer what he desires. But it is not the only one. Let's look at what a fishing reel company has done. The Bronson Reel Co of Bronson, Michigan, was being priced out of the market by Japanese imports only two years ago. It decided to fight back.

Instead of becoming a clearinghouse for imports, Bronson designed and put into production a closed-face spin casting reel, the Dart, selling at retail for $5.95. Demand was so great that employment increased one-fifth. What's more, the sales impact of the Dart stimulated the market for Bronson's other models.

Bronson's designers . . .

came up with four more new bait casting reels and by the end of last year Bronson had made the biggest percentage gain in the industry. Bronson's satisfying success can be attributed to the management's recognition that it must give the public what it wants at the right price.

The impact of compact cars, the success story of the Bronson company, and the experience of other manufacturers who have done what Detroit has done, give weight to the conclusion that any industry threatened by foreign competition should not look to Washington for preservation.

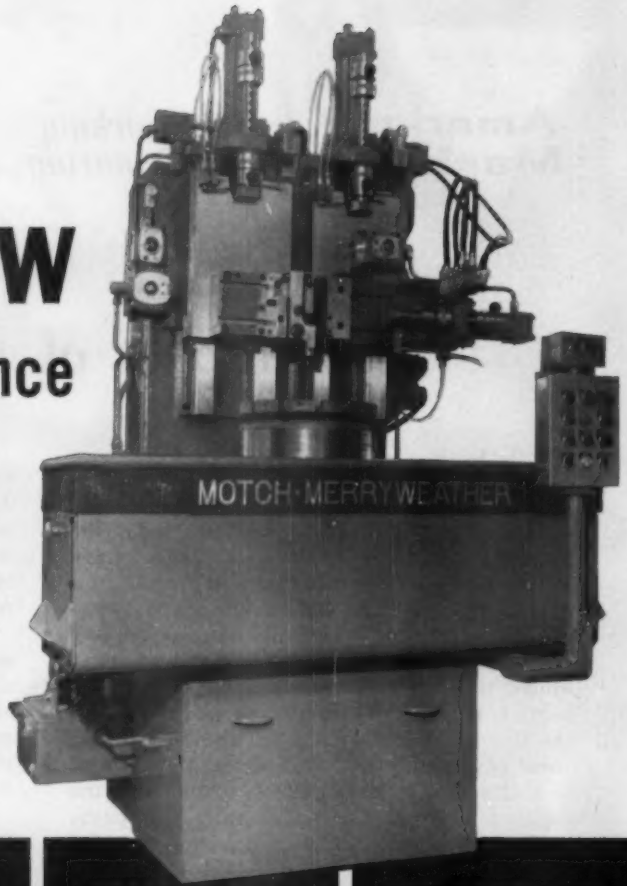
Instead it should build . . .

the best products that its customers want and need. It should get its own costs down and do its best to keep its prices in line. It should outdesign foreign competition. It should constantly be guided by the fact that customers are not going to buy more than they want or need.

Every metalworking manufacturer beset by competition from imported goods should take heed of the impact made by the compact.

Burnham Finney EDITOR

NOW
a high-performance low-cost Vertical Turner



M & M Vertical Turners offer 3 key advantages in turning, facing, boring and tracing operations

SIMPLICITY

The Vertical Turner is not one machine, but a line of machines designed with standard components. Arrangement of components for a specific job will provide high efficiency at low cost. The machine is built with only the minimum components and accessories you actually require.

PERFORMANCE

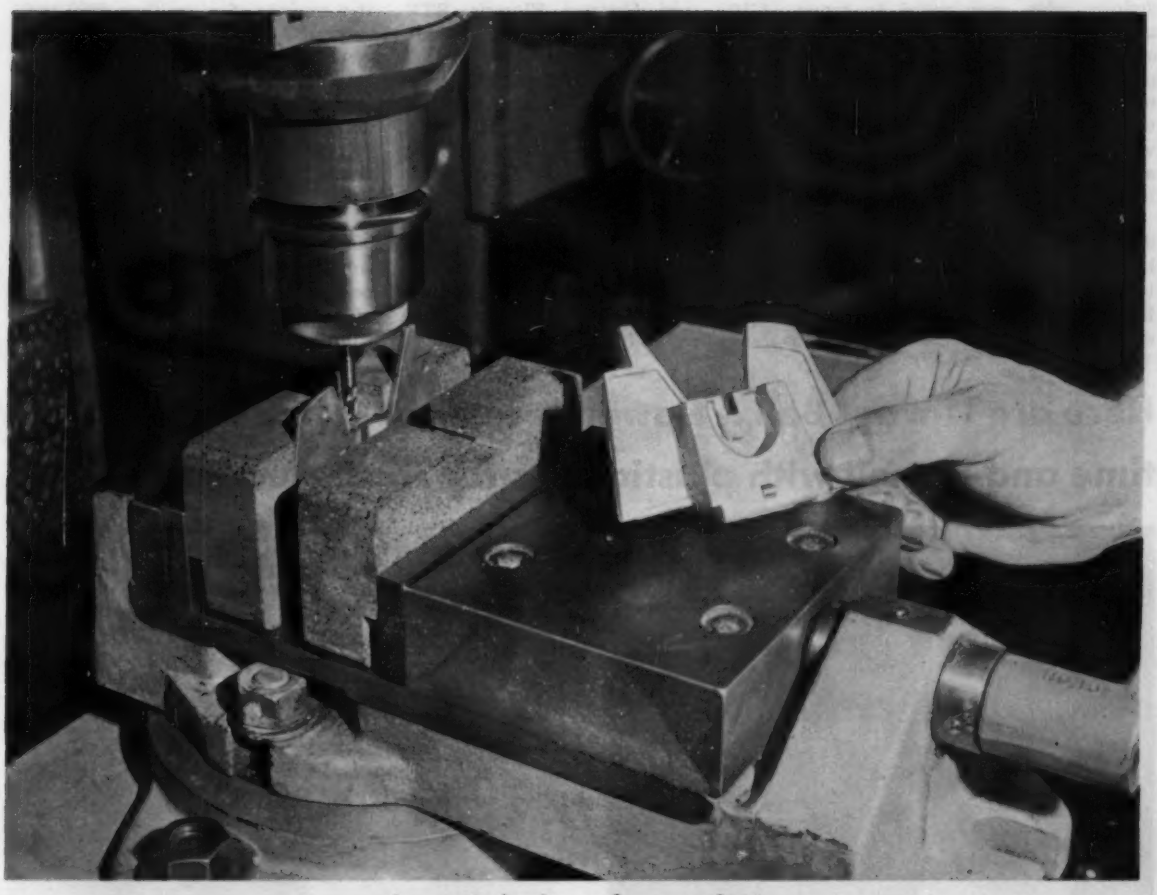
The Vertical Turner has the rigidity for heavy roughing cuts and precision finishing. It has the capability for high production or short lot runs. A wide choice of accessories is available.

VERSATILITY

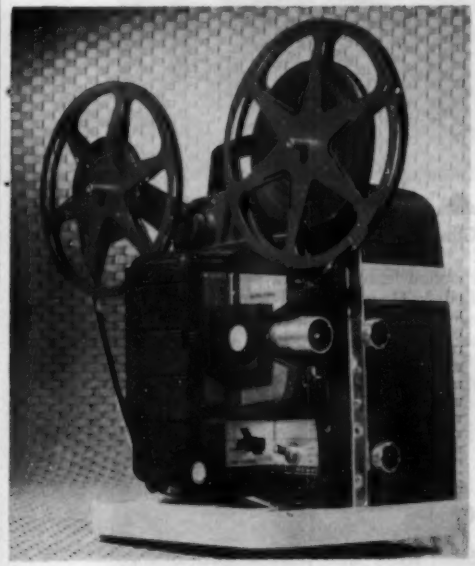
The machines can handle a wide range of multiple operations, programmed with automatic cycle to suit. Tool set-up is simple and quick. The building block concept permits rearrangement of the basic machine in the field to suit job changes.

Your local Motch & Merryweather representative has an informative visual presentation of this design concept. For the full story call him, or write Motch & Merryweather Machinery Company, Machine Tool Manufacturing Division, 1250 East 222nd Street, Cleveland 17, Ohio.

MOTCH AND MERRYWEATHER



Low-cost vise jaws of epoxy plastic . . .
. . . take only 3½ to 4 hours to make, contrasted with 4 hours of tool design and at least 8 to 10 hours in the toolroom for steel jaws. These jaws, which hold odd-shaped aluminum die castings, are made from room-cured plastic cast to master parts



Typical product . . .
. . . of Bell & Howell is this automatically loaded 8-mm projector. Epoxy plastic tools, cast to fit from prototype and production parts, locate and support a number of its parts during production

Cheap plastic tooling for short runs

By George Bruckner, manager Tool Engineering Dept, and
George Libonati, plastics tooling technician, Bell & Howell Co, Chicago

In an industry where market life of a particular model or product is short, tooling changes become a major expense item—much more so than in an industry which has a product that is turned out for years on end with little design change.

Short market life of a model is characteristic of the camera and projector industry, where the product is constantly being improved in response to customer demand for more and more automatic features. Because of this, a wide variety of precision instruments must be made in moderate-sized job lots at competitive prices.

Low-cost tooling is thus of vital importance, and plastics seem to be the answer. They have definite advantages, aside from cost, over conventional metal tools. For instance, metal tools take a long time to make, and they are difficult to revise when model changes come through. Even so, metal tools still must be employed in many instances.

But lower-cost plastic tooling has a

definite edge over metal in many applications. It has advantages, too, over plywood tooling, which in the past has been used in place of metal for making jigs and fixtures, in attempts to cut tooling costs. Trouble with plywood jigs and fixtures is that accuracy is not too good, and locating points quickly break down.

In the last several years, introduction of plastic tooling techniques has opened an entirely new approach to tooling economies. At Bell & Howell, for example, we have used epoxy resins, plaster, Perma-Flex CMC, and General Electric RTV silicone rubbers to produce a wide variety of jigs and fixtures for assembly and testing operations, for inspection fixtures, and even for prototype and production parts.

Bell & Howell's Plastic Tooling Section, started in the summer of 1957, has taken over a bigger and bigger share of the company's production tooling programs. For example, in 1957 only 50 work orders for 12 departments were processed.

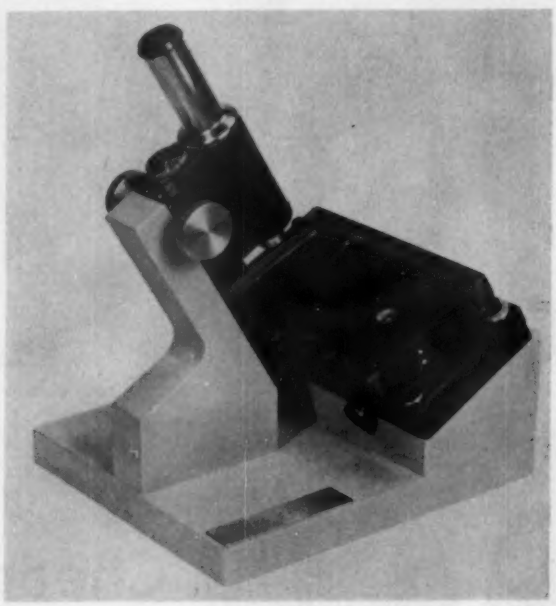
In 1958 the section processed 109 work orders for 175 individual tools, at a savings of more than 5000 toolmaking hours by comparison with metal toolmaking.

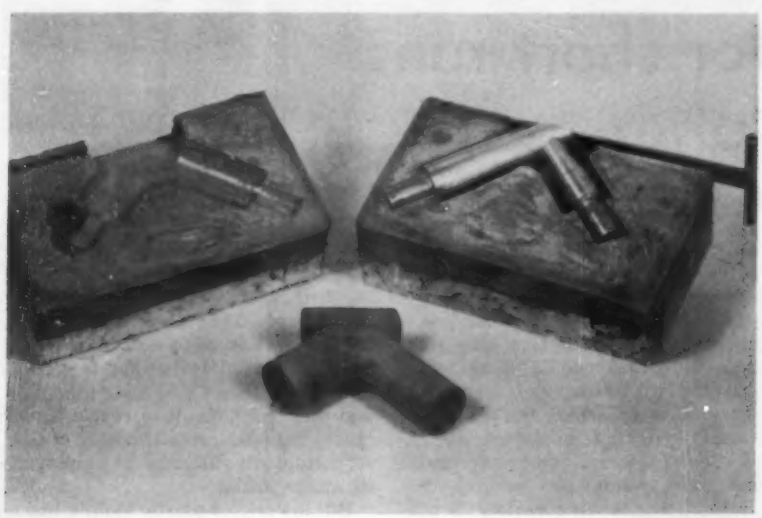
Last year, 280 work orders for 300 individual tools were processed by the Plastic Tooling Section—with a saving of approximately 12,000 manhours.

Here are some examples of how Bell & Howell has saved money with plastic tooling on short-to-medium runs. Plaster molds, room-cured rubber and epoxy tools and work were all produced by closely following suppliers' recommendations.

Here are 11 ways Bell & Howell is saving tooling time and money with plastic tools for short runs

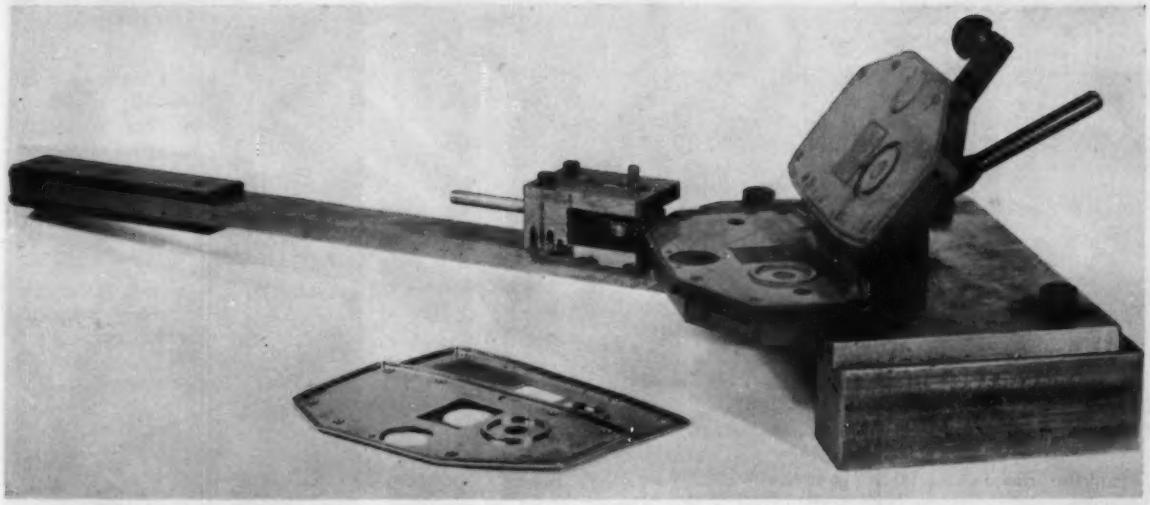
Molds are built up . . .
by casting plaster or epoxies around models on these two large granite surface plates. Overhead exhaust hood and spray booth are connected to a 6000-cfm blower to remove fumes. Oven at rear hastens curing of epoxies, plasters, various adhesives, plastisols, and rubber compounds



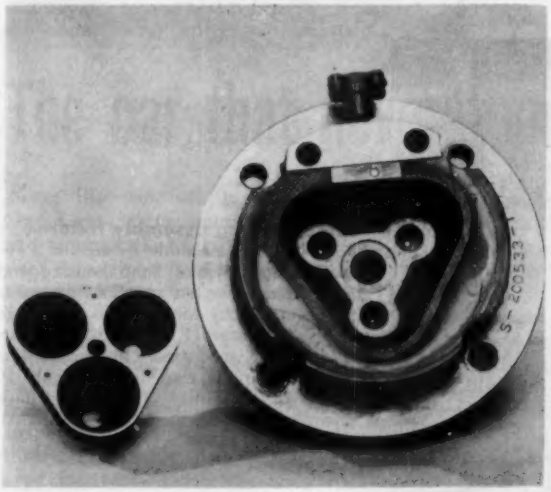


Cast epoxy nest . . .
. . . on tilted table of this optical inspection fixture aligns a partly assembled Bell & Howell Model 292 8-mm movie camera for precise checking of the shutter position. The nest was made on a steel backing plate in about 2¾ hours. A comparable metal nest would take about 24 hours to make

Sisal fiber and plastic backup . . .
. . . are combined with Perma-Flex CMC to make two flexible mold sections (rear) in which an epoxy plastic tube with a slot for a reflecting mirror (foreground) is cast for an inspection fixture. Cores are aluminum

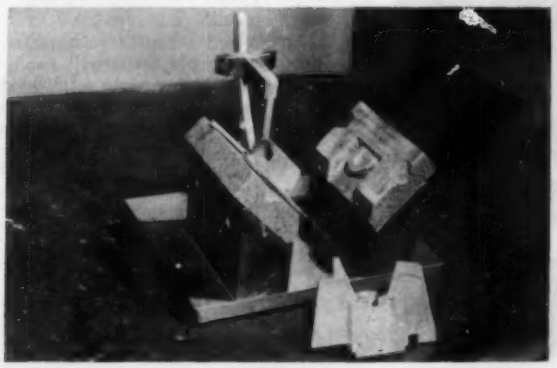


Aluminum alloy side plates . . .
. . . 0.025 inches thick and measuring approximately 4 x 7 inches for a Model 240 16-mm movie camera are beaded along the edges with hand-operated fixtures such as this one. A spring-loaded roll follows the contour of the part, which is held between two cast epoxy form blocks bolted to steel support plates. The two castings were made in 3 hr



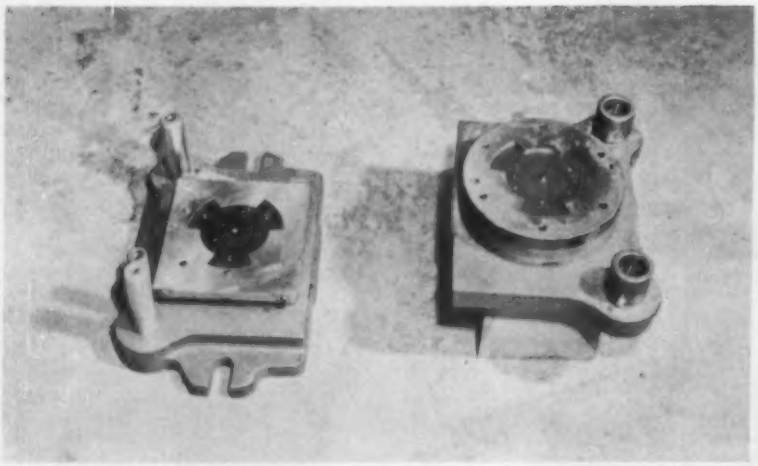
Lathe faceplate fixture . . .
. . . is made from metallic epoxy cast inside a cup to nest workpiece centers, holding cast-aluminum movie camera lens turrets for a facing operation. The plastic was cast on a production part

Epoxy nest in a routing fixture . . .
Undercuts bored in the steel pocket of this routing fixture hold a cast epoxy nest, in which movie camera lens turrets are faced and undercut with an end mill. It would have taken 12 to 16 hours to mill such a shaped pocket in a steel fixture: Casting the epoxy nest to accurate size in the bored hole took just 2 hours



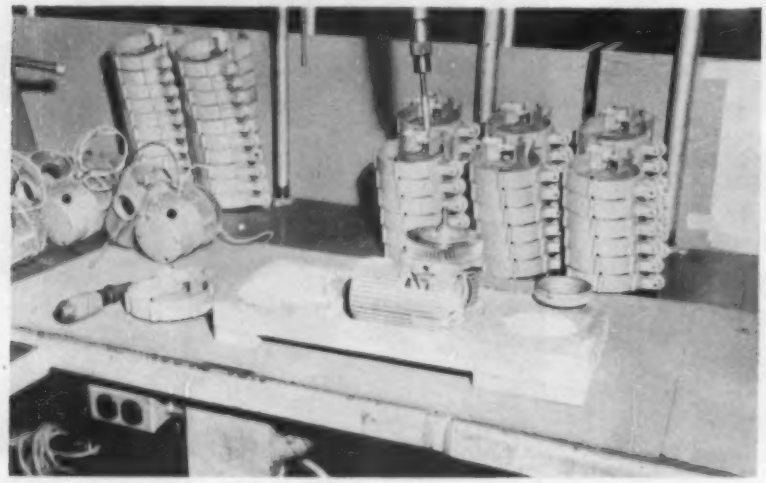
Epoxy milling fixture . . .
Cast epoxy nest blocks were bolted to angled steel base blocks to make this two-position milling fixture for chamfering sides of die-cast aluminum part for B & H's Lumina 1.2 8-mm movie camera. The two nest blocks were made in 3½ hours, can easily be replaced with other nest blocks if part design is changed

Cheap plastic tooling for short runs . . .

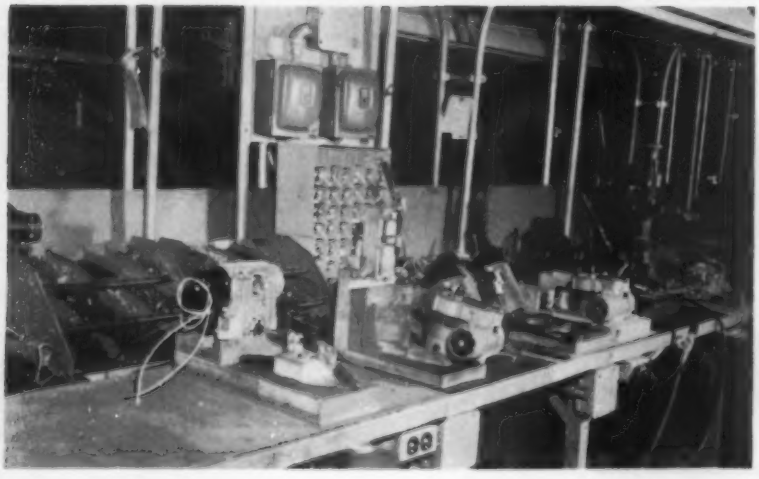


Blanking die . . .
Spring-supported shedder plate in die (right) of this blanking die for an aluminum fan for a movie projector is a ¾-inch thick epoxy casting made in about 3 hours (a steel plate would have taken at least 12 hours to make). Shedder plate was cast directly in the die opening after the steel surfaces were waxed and sprayed with a silicone release agent to provide operating clearance. The epoxy shedder, which prevents scratching of the work, should last the full life of the die

Vibration test fixtures . . .
Cast-to-shape epoxy fixtures hold assembled 8-mm cameras on a stand for final vibration tests. Hold-down clamps are not needed for testing 8-mm cameras, but are necessary for 16-mm camera tests



Lamp housing assembly fixture . . .
Three-position assembly fixture for a 16-mm movie projector lamp housing and blower assembly has part locating nests cast in an epoxy top plate to the shape of plaster masters. Epoxy plate is mounted on a plywood base. Plaster masters and nested plate were made in only 16 hours. Other fixtures of this type have separate cast nests



Projector assembly fixtures . . .
Epoxy nests are blocked into a plywood frame in this line of four assembly fixtures for 16-mm movie projectors. Parts are easy to locate in these fixtures, cutting assembly time materially. Individual epoxy nests insured that cost of fixtures were held to a minimum

Monorail cradle dips car down and wheels touch the ground for the first time. Corvair body is suspended from overhead conveyor throughout entire assembly operation.

Body hovers over front and rear suspensions. Hydraulic lifts bring components up to position where they are attached to car body

The car that never touches the ground

From the time its integral body-frame enters the assembly plant to the moment the fully assembled car goes through its final inspections, the Chevrolet Corvair never touches the ground.

In contrast to conventional assembly methods, the Corvair's rear-mounted engine, transmission and transaxle, and its front and rear suspensions, are sub-assembled and then lifted up to, rather than lowered into, the frameless body. All this is made possible by a 3500-ft-long overhead conveyor, the outstanding feature of the Chevrolet-Willow Run plant, a plant designed and built exclusively for assembly of the Corvair.

Assembly begins with reception of the integral body-frame from the adjacent Fisher Body assembly plant. Because of this integral construction, 25% fewer final assembly operations are required than on a separate-chassis-and-body car.

Six-section assembly line

The main assembly line is divided into six sections. At the end of each section, the overhead conveyor carrying the car body lifts it higher as it makes a U-turn to the next work area.

The main gas line, the brake lines, steering gear, windshield wiper motor, radio speaker, instrument cluster, and heater are fitted to the car on the first section of the final assembly line. Some components, like the instrument cluster, have been put together on a sub-assembly line which feeds the main, or final, assembly line.

After thorough inspection, the body goes to the second section, where such parts as the radio, glove box, brake and clutch pedals, ash tray, windshield wipers are added.

Following another inspection, the body moves on to the third section. Here the headlights, back-up lights, front and rear bumpers, horn, and gas tank are affixed.

The "marriage"

After it is inspected once more, the body goes to the fourth section of the final assembly line. As it moves along this line it meets its front and rear suspension systems, the engine, transaxle and transmission at what is called the "marriage."

At the marriage these sub-assemblies are lifted hydraulically up to the body and secured to it. As the car, which by now begins to look like a car, proceeds to the fifth section it is fitted with wheels, battery, steering wheel, and other parts.

Not until the car enters the final section of the line is it lowered to a floor-level conveyor. Here the car is inspected once more, a few adjustments are made, the engine is started, and the car is driven off the line under its own power. But the trip is a short one—to another inspection station. The car stops on a set of rollers under each wheel, and the steering, transmission, and other components are tested.

In laying out this plant, designers and production experts provided 87 work stations, but provision was made for 213 individual inspections during assembly.

Rigid inspection

In addition to regular inspection operations, the Corvair undergoes many unusual, rigid checks. The blower which cools the engine is checked out for balance at speeds up to 10,000 rpm (about 50% faster than operational speed). Imbalance sensitivity is 0.04 ounce-inch. The rear-suspension cross member is assembled on a gage that indicates to the operator whether all inter-hole dimensions are within 0.020 in. over a distance of almost two feet.

A sign at the delivery exit tells assemblers "Your next inspector is the customer."

New weapons of lightweight-but-tough alloys are . . .

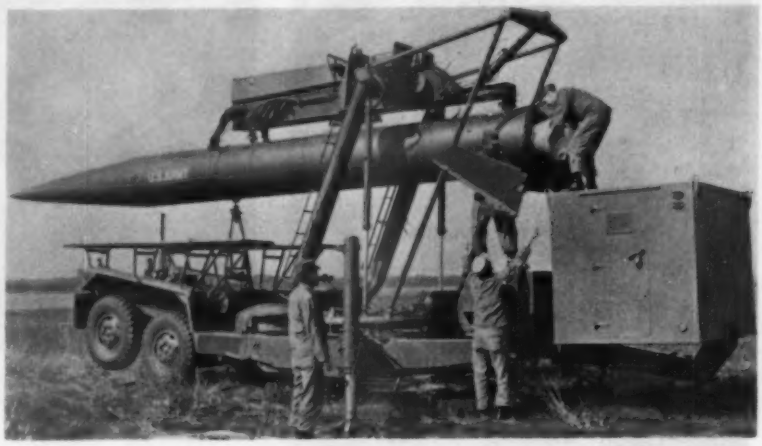
Beefing up our ground forces

Strong but light new alloys are playing a major role in helping the United States ground forces to achieve the military ideal of mobility and firepower.

This was dramatically proved in the Army's recent widely publicized Project MAN (Modern Army Needs) demonstration at the Infantry School, Fort Benning, Ga, where 600 top government officials (including President Eisenhower), military officers, industrialists, and the press had a chance to examine the new weapons and to see demonstrations of what they can do.

The influence of new lightweight steel and of new aluminum and magnesium alloys on design of the new weapons was readily apparent. Some examples:

- The new Chrysler-built M-60 tank—the first with aluminum road wheels, support brackets, fenders and fender boxes, storage racks and fuel tanks—3½ tons in all.
- First use of U S Steel's new T-1 alloy steel, in a mobile launcher for the Sergeant missile (photo). Weighing only 16,000 lb, the launcher can be carried by plane. Made with regular steels, it would weigh 23,000, have about one-third as much yield strength.
- The M274 "Mechanical Mule" weapons carrier. Made largely from aluminum and magnesium, this is the first tactical military vehicle capable of carrying more than its own weight—900 lb. The M274 can carry 1000 lb.
- The LARC-5 and LARC-15 amphibious cargo carriers. Made of welded aluminum, these carriers despite their lightness are capable of withstanding extremely heavy seas.



Mobile launching platform for the Army's new Sergeant missile weighs only 16,000 lb, can be carried by plane. Made from U S Steel's new T-1 constructional alloy steel, the launcher weighs 7000 lb less than if made with standard steel

New plant, new ideas mark Norton's 75th year

Opening of a $6.5-million plant for manufacturing organic bonded grinding wheels was chosen by Norton Co as the opening event in a series to celebrate the firm's 75th Anniversary. The new Plant 8, for resinoid, rubber, and shellac wheels, increases output of organic wheels and incorporates many improvements to refine wheel uniformity, reduce manufacturing costs, and improve working conditions.

Automatic weighing equipment operating on a monorail and controlled by punched cards assembles batches of wheel mix in the specified proportions and delivers them to mixing machines.

Because of the variety of wheels produced and the small size of the lots, little automation has been incorporated, though there is extensive use of roller conveyors and many of the wheels are baked in tunnel ovens.

Recently Norton announced that the research laboratories had succeeded in producing synthetic diamonds of industrial quality. Norton has applied for patents on its method, but hasn't indicated that it will go into commercial production. General Electric was first to produce diamonds (1955) and Norton has worked with GE on the application of man-made diamonds. The GE patents have not been issued yet so Norton is unable to say how different its method may be. De Beers Consolidated Mines has also applied for patents on a method of producing diamonds.

Other recent developments include 75 Alundum—an abrasive with a specific type of crystal for billet and slab grinding of stainless steel, and a variety of refractory products used in missiles, nuclear power plants, and electronics.

Founded as the Norton Emery Wheel Co in 1885, Norton now has 200,000 varieties of grinding wheels. There are 24 plants, including 18 in foreign countries.

Major divisions of the company produce machine tools, refractories, and other products. The main plant in Worcester, Mass, is 1½ miles long and includes 124 buildings with 3.5 million square feet of manufacturing space.

First president of the company was Milton P Higgins and his grandson, also Milton P Higgins, is president today. Another of the founders was John Jeppson. His son is today Board Chairman, and his grandson is general manager of the abrasive division.

During the two-week series of open houses, several other new buildings will be on display, including the new central service building which handles maintenance and repair for the entire Worcester plant and builds the special machinery required to mold and true grinding wheels.

AUTOMATION JITTERS

Careful indoctrination helps overcome worker fears

Workers tend to run scared on their first jobs in a highly automated set-up—so much so that without careful indoctrination and training they can upset the production applecart in the best laid out plant.

In other words, installation of automated systems is no guarantee that manufacturing processes will run smoothly, unless adequate consideration is given to the human element. This is the warning of two University of Michigan social science researchers, based on a detailed comparison of two electric power plants, one conventional and the other highly automated.

The fact that their guinea pigs are electric power plants is immaterial. The researchers, Floyd C Mann and L Richard Hoffman, are concerned with the psychological effect of automation on workers, not on specific production processes.

A company, they say, is a "total social system," much as a community is. Trouble is, the engineers responsible for setting up new production processes are too much concerned with technology, too little concerned with the effect of sweeping changes on the people involved.

Too often, eager managers bypass human factors in an effort to hit immediate peak production in their new automated setups. Then they seek to undo the damage they have done, by "patching up" technological devices to meet psychological needs. This is all wrong, according to Mann and Hoffman—automation from the first should be planned with people in mind.

For instance, workers frequently fear the new automated machines they must run. For this reason, it pays to go slowly and not press too hard for peak production in newly automated plants.

"Give operators a chance to learn by doing, or costly breakdowns may occur," Mann and Hoffman warn. Automation, they say, should proceed by stages, with as many alternatives as possible, instead of being precommitted to one irrevocable plan. Company policies should also be clearly stated to employees displaced by the new process.

The slow approach

This exploratory survey, specifically undertaken to discover major problems to be studied in the future, points out that job upgrading and rotation give meaning and satisfaction to workers, and result in increased productivity. But if management at the same time, in order to get the most out of an expensive installation, attempts to run it around the clock, workers' home lives and social lives will be disrupted. Utmost care must thus be taken to see that shift scheduling and job rotation are planned so as to be pleasing and beneficial to the worker.

Workers in the automated power plant, for instance, preferred rotation of shifts on a weekly, rather than a monthly basis. Best from the workers' viewpoint: a schedule of 7 days on, 1 day off; 7 days on, 2 days off; then 7 days on, 4 days off.

Actually, most interviewed workers didn't like shift work at all—too much disruption of sleeping and eating habits. Interestingly, shift work was once regarded as a form of job security, because plants had to operate 24 hours a day. But now, unemployment insurance and social legislation makes this less important.

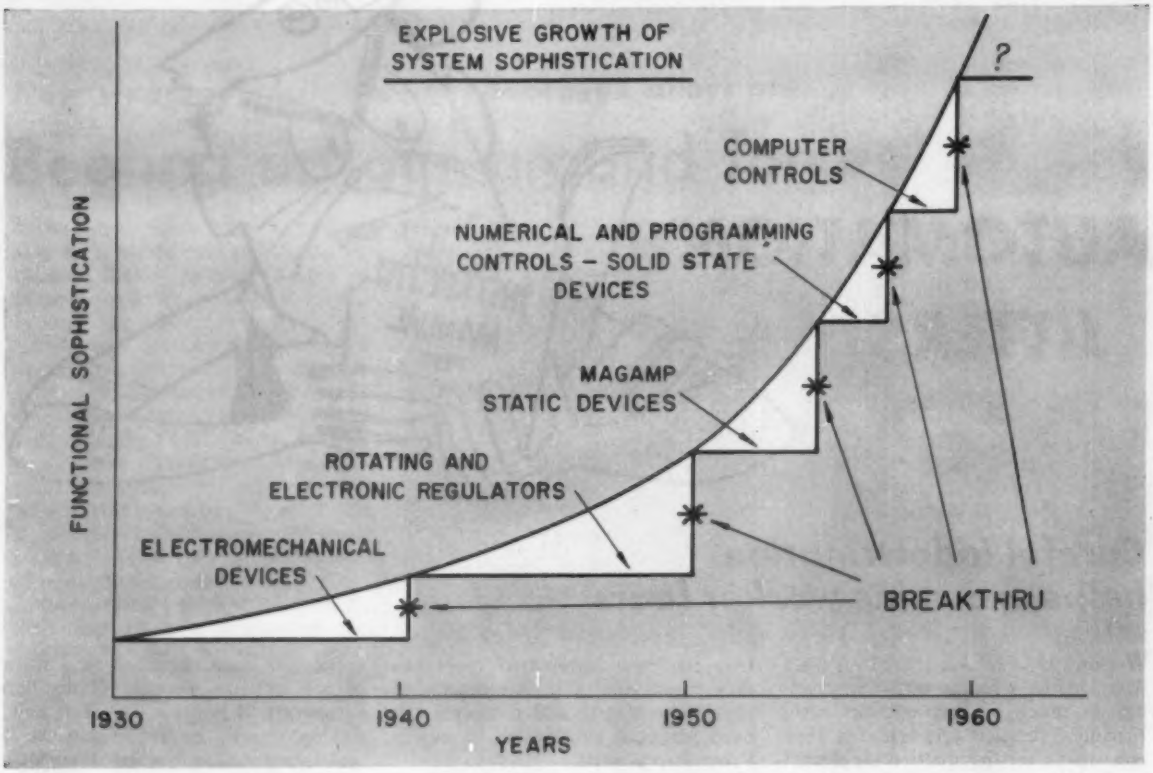
Automation often keeps people apart when they are on the job. For this reason, shift rotation must be devised to satisfy man's gregarious nature—to allow him to get home as frequently as possible during the hours when he can enjoy his family.

Gradual transition into automation may be necessary, the study points out. Over the years, the company tends to keep employees who favor stable institutions, and to let go those who favor rapid change. Yet the so-called "stable" employees are the ones most likely to see automation as a threat to their job stability and to their established way of life.

Traditional methods of job evaluation do not apply to automated systems, simply because the worker has little control over quantity and quality of production.

Those are the problems of automation today and in years to come. On the bright side, however, Mann and Hoffman found that workers transferred from the old plant to the automated one appreciated their greater job responsibility and opportunity—much more so than young, new workers who had never worked in the older plant.

For the most part, the researchers conclude, employees will find that if technology and psychology go hand in hand in the planning of automation, workers will meet the challenge of new methods and upgraded jobs with enthusiasm.



Collapse of time is vividly shown in the acceleration of "breakthroughs" in power and control development. The little question mark makes one wonder whether a new scale isn't necessary before functional sophistication becomes infinite. Breakthroughs in power sources and engineering materials will further boost the rate of progress

Standards speed electronic control

Metalworking is entering a new world of electrical power. While motors and other conventional manufacturing muscles won't be taking a back seat in any respect, they will have some powerful partners.

Already, says Bruce Minturn, manager of Cincinnati Milling Machine's Electrojet Dept, more than 1000 electrical discharge machines are in use. And 250 more units will be sold during 1960, with 20 to 30% increase per year beyond this one. It is amazing, he points out, that the practical application of electrical-discharge machining has preceded understanding of the principles of the metal removal phenomenon.

In less than 10 years, users of electrolytic machining equipment appear to number about as many as electrical - discharge installations. (Electrolytic machining defines metal removal by electrolysis or electrochemical action. It is similar to the erosion which occurs at the anode in an electroplating bath and, naturally, operates in an electrically conductive solution. Electrical-discharge machining is accomplished in a dielectric or non-conducting solution and metal is removed by a spark passing from the electrode to the work. Neither process is limited by metal hardness.)

Lynn A Williams, president of Anocut Engineering Co, Chicago, mentioned that a trend in electrolytic application is the use of larger machines to permit grinding larger tools. Users now are grinding both the carbide-tipped portions of tools and the steel shanks. In addition to sharpening both single-point and multiple-tooth cutters, more and more production applications are developing for the electrolytic process.

A fairly recent partner for these metal-removal processes is electrical-discharge forming. Also called "electro-hydraulic forming," the equipment might be best known to industry as the "spark bomb." In this technique, a high-energy spark discharge under water offers a controllable explosion effect.

"Engineering for Tomorrow—in the Machine-Tool Industry" was the theme of the 1960 Westinghouse Machine-Tool Forum in Pittsburgh. Speakers, including the foregoing, discussed during the two-day conference the impact of power plus control on manufacturing.

Announced at the meeting was the availability of the Westinghouse Prodac system for numerical control of machine tools. Some years ago Westinghouse decided to introduce its numerical-control equipment via a different route from that followed by most control builders. Thus the company applied its numerical-control system first in the process industries. Prodac (Programmed Digital Automatic Control) has been successful in a number of rolling mill control installations. Now the system has been engineered to provide positioning control for machine tools. It is a digital, all-transistorized, static system of modular construction. Price of the two-axis positioning system, with two fractional-horsepower feed motors will run around $12,000.

Reliability of PRODAC is said to be greatly enhanced by its all-static circuitry. With no moving parts—nothing to wear—maintenance prob-

lems are minimized. Completely transistorized logic circuitry provides faster response than conventional control relays. A Westinghouse Trinistor servomotor-drive is used to control each feed servomotor and a precision rotary pulse generator—called ROTRAC—provides feedback signals.

In operation, position command is fed in from one-inch, eight-channel, perforated paper tape. After computation by the control unit, the information goes to the Trinistor servomotor control to energize the servomotor and set the machine tool in motion. One to five motions can be controlled to 999.999 in. span—and all auxiliary functions are also controlled. Electrical accuracy is ±0.0005 in., with higher accuracies available for special applications. Each machine motion is sensed by the ROTRAC pulse generator and the position is fed back to the PRODAC control unit where it is compared with the input information and corrected if necessary.

During a discussion of electrical standards for machine tools, Nelson P Bashor, director of electrical controls, W F and John Barnes Co, said that the legal aspects of electrical standards are becoming increasingly important. This is something new to the National Machine Tool Builders' Electrical Standards Committee. While, as a simple industry standard, there is no compulsion to observe the recommendation, there is increasing likelihood that the standards will be the basis for legal codes—which must be observed. Thus it is wise to consider legal aspects as standards are developed.

L W Herschenroeder of Westinghouse described the activities of the Electronic Industries Association's sub-committee on numerical control. Thus far, Standard RS-227 is official for one-inch-wide, eight-channel perforated tape. Std 621 establishes character coding of tape. It is an adaptation of the Flexowriter code. There still remains a problem of resolving differences in how tracks (of perforations) should be numbered on the tape. Committee TR 23.1.2 on word-and-block format now has a system of axis nomenclature which is widely applicable. The committee expects that it will be accepted.

Standards for electrical equipment operating at from one to fifty volts and safety standards for inadvertent application of 120 volts to low-voltage systems are among the National Electrical Manufacturers' Association projects described by D L Pierce, asst manager of the Westinghouse Systems Control Dept.

NEMA is working on standard symbols for static controls, as is also the EIA. However, the standards developed by EIA are felt to be more useful to electronics engineers than to the engineer in an industrial plant.

Building the Boulder cyclotron

Some 170,000 lb of magnet is the core of a new research cyclotron to be installed by the University of Colorado at Boulder. To make this magnet accurate and controllable, Bethlehem Steel Co has to fabricate the huge magnet parts on some of the largest planers and vertical boring mills in the country, and finish the parts to thousandths and to micro-inch finishes.

The pole tips (see cover and p 1) were most critical, and had to be machined to parallelism within 0.004 in. on a 52-in. diameter. The most effective technique was one of the simplest possible; the poles were machined accurately, then assembled and measured. Then they were taken apart and the lower pole machined again at a 16-ft vertical boring mill to dimensions found by inspection of the assembly.

Gap readings between the poles were recorded, then the indicator on the mill was set up to match these readings. The partly disassembled main yoke, pole yoke, and pole tip were set on the machine table so high spots would be removed with a final, finishing cut.

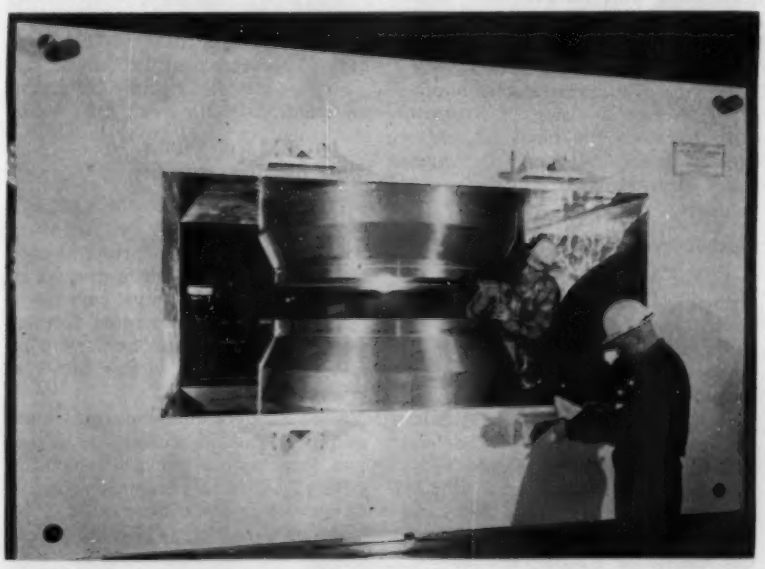
Huge parts

The magnet consists of a rectangular yoke assembly 142½ in. long, 60 in. wide, and 88½ in. high with an opening of 96 by 42 in. This is a unit of four members, weighing 146,000 lb, held together by large dowel pins and studs. Pole pieces are tapered on the sides from 59 to 52 in. on the diameter, and are 14.4 in. thick. They are Armco iron of low carbon content.

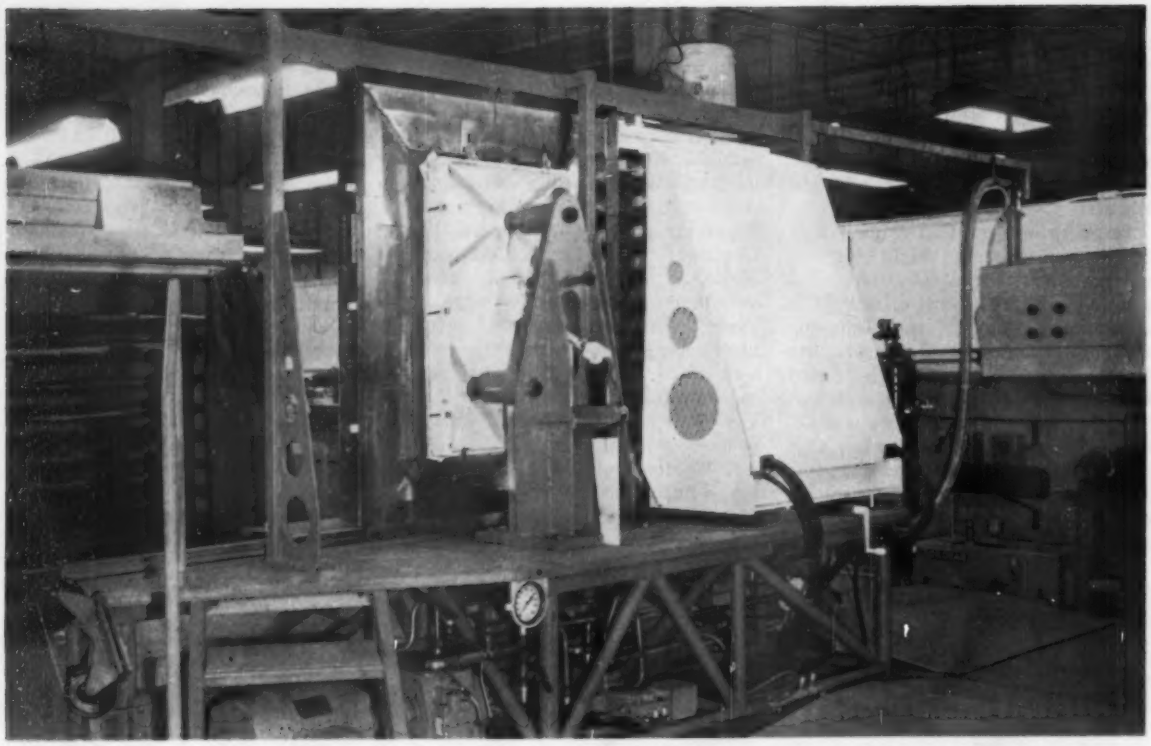
Yoke members were forged in a 7500-ton hydraulic press, then machined to 250-micro-in. with mating surfaces finished to 125 micro-in.)

Pole tips were machined a few thousandths oversize, then the final fitting and machining was done.

The Boulder cyclotron will have a capacity of 10-30 million electron volts, and is a strong-focusing type. Final electron speed will be built up to 1/5 the speed of light, at which the electrons will strike a target.



Magnetic gap is measured between pole pieces so cyclotron yoke can be disassembled for a final machining cut on pole face



Honeycomb panel moves through brazing process automatically. Here it has left the heat lamps (right) and is held between chill forms while cooling. Highly reflective ceramic gold shields protect support carriage during heating

New process brazes faster, better

Banks of radiant quartz lamps and precision electronic controls to regulate time and temperature—these are the heart of a new process for brazing stainless steel sheet to stainless honeycomb core. Called Nortobraze, the technique was developed at the Norair Division of Northrop Corp to meet the need for better ways to braze the panels for supersonic aircraft, missiles, and space vehicles.

Slashes cycle time

An outstanding advantage of the process is that it cuts the conventional 3- to 12-hr brazing cycles down to 5 to 15 min, depending upon the complexity of the panel being brazed. It has already brazed titanium alloys in addition to stainless and can be applied to molybdenum, columbium, and other exotic alloys.

Now the company has a $956,447 Air Force contract with the Manufacturing Methods Div, Air Materiel Command, at Wright-Patterson Air Force Base. The seven-phase contract covers the application of Nortobraze to making stainless steel honeycomb panels in a variety of shapes, sizes and thicknesses.

The major components of the brazing machine are: two banks of the radiant quartz heating lamps, opposing chill-form dies which clamp the panel for cooling, and the control equipment.

High heating capacity

The lamp banks have a total output of 200,000 watts per sq ft of honeycomb panel, but present applications take only about a quarter of that amount. The lamps, capable of reaching 6000 F from room temperatures in 4/5 sec, can be turned on and off selectively to put the heat where it is needed.

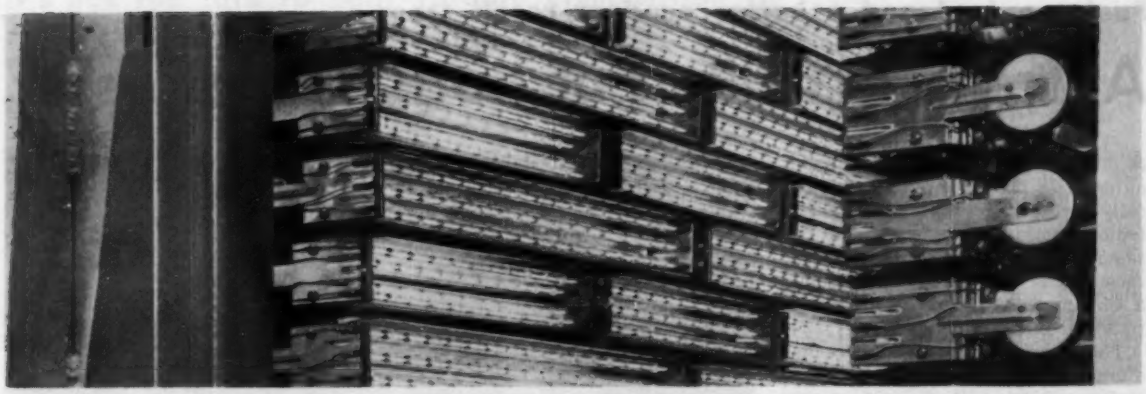
Precise electronic controls maintain temperature within one degree and time within one millisecond, a critical factor in brazing sensitive alloys where the difference of a degree or two in temperature can change the joint charactristics completely.

These controls receive detailed temperature information from thermocouples attached to the metal envelope in which the honeycomb panel is brazed. At the same time, scanning devices are sending in the command data that they read from pre-drawn graphs. By comparing the information from the two sources, the control regulates temperature and time to provide uniform heating even when the panel being brazed varies in density.

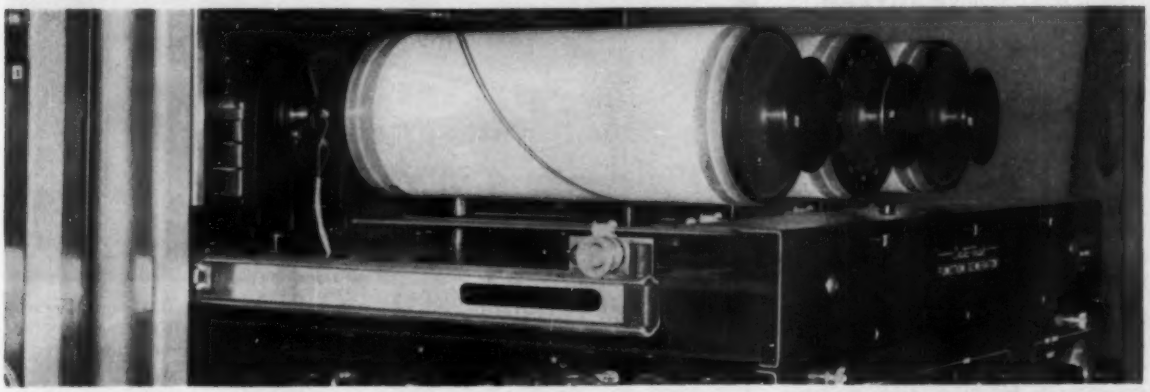
As a result, the process is highly flexible; any portion of a part can receive any desired amount of heat. For example, the trailing edge of a tapered panel is nearly 100% dense metal joined to a core which is about 98% air and only 2% metal. With these automatic controls and the variable heat source, structures of this type are no problem.

How it works

At the start of the brazing operation, the panel, already welded into an airtight metal envelope, is positioned between the lamp banks, and the envelope is purged of air and



Two banks of radiant quartz lamps heat the work from both sides. Selective control over lamps permits varying heat input to different areas. This view into heating station shows only a portion of the lamp bank

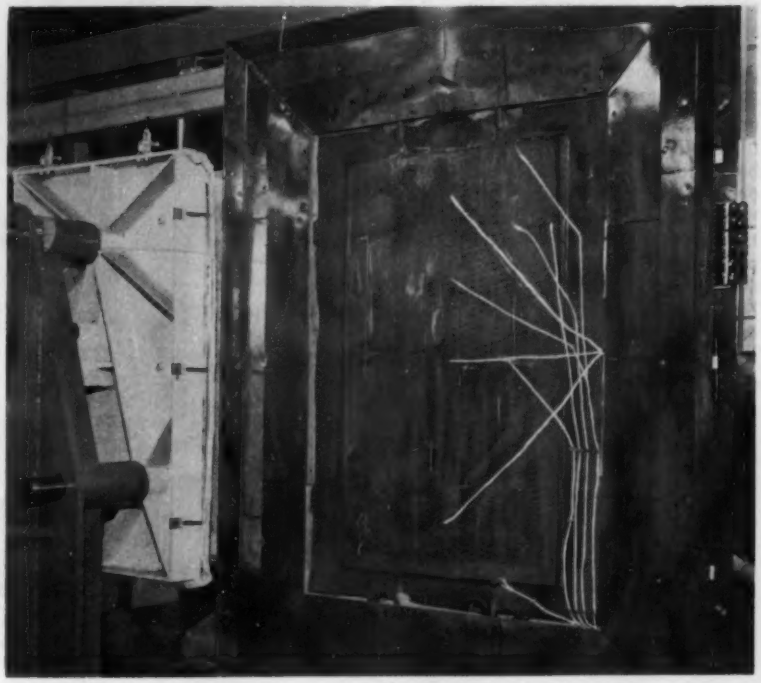


Data-Trak programmers scan plot of established time vs temperature values to provide automatic control of Nortobraze process. Plots are drawn on ordinary chart paper and then fastened to six drums in control (three shown here)

filled with argon gas. When the lamps are turned on, the panel temperature rises rapidly to 1725 F, where it is held for a time interval that depends on the complexity and configuration of the panel.

As soon as the heating is complete, the machine automatically shifts the enveloped panel to the next station. Here the opposing dies clamp it until the temperature drops to a point where dimensions of the panel will remain stable.

One of the most significant results of the new brazing technique is an improvement in the physical properties of stainless honeycomb panels instead of the reduction of these characteristics which commonly occurs in conventional furnace brazing. With the improved brazing cycle, elongation has been increased from 3% to 7% and tensile strength increased from 190,000 to 245,000 psi.



Thermocouples send temperature information from strategic points on brazing envelope. Completed panel here is in load-unload station

Faster output and a better product result from . . .

Automatic milling of body templets

A one-of-a-kind machine is cutting automobile body templets automatically at Ford Motor Co, eliminating tedious manual operations and at the same time achieving higher accuracies than before. The machine: a Cincinnati vertical Hydro-Tel optic electronic scanner.

The templets in question are flat aluminum sections for shaping the surfaces of three-dimensional wooden models of body components (see photo lower right).

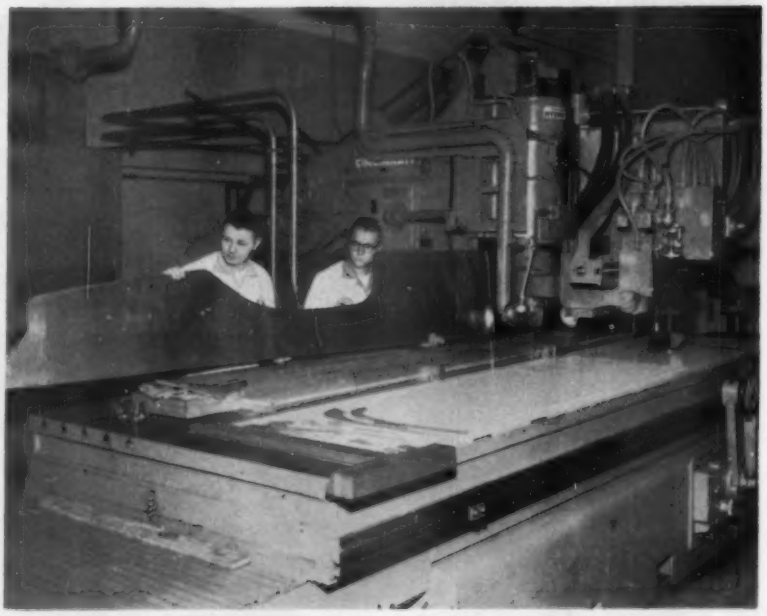
Until now, templets were made by extracting vellums or tracings from the original body draft. These were placed on an aluminum blank and the tracing was prick-punched through onto the metal.

Then, the dots were connected on the metal with drafting curves; the piece was sawed, hand-filed, and finally fitted to the original draft. If the templet was more than 0.005 inches off original dimensions, it was rejected.

Ford's new Cincinnati machine now does the job automatically and to accuracies within 0.003 inches. The machine operates automatically through electronic controls that include a cathode ray tube, a photo multiplier tube, a projections lens, and a photoelectric eye. Mounted above the milling machine table, this apparatus acts as a scanning device, "radar warning" system, and "automatic pilot."

The cathode ray tube projects an oscillating spot of light on the drawing (which is positioned on the first half of the work table). Operator positions the drawing so that the bow-shaped light signal straddles the line "to be cut." The signal (which passes back and forth across the line 400 times per second) is measured by a photo multiplier tube—as the entire rig automatically follows the line. This tube compares the length of time it takes for the spot of light to travel from one side of the line to the other. When the device computes that the arc is not centered on the line, the machine is corrected in its trajectory and brought back to dead center.

Meanwhile, the cutting tool duplicates the same path as the light signal, reproducing the movement of the scanner within 0.003-in. on the blank, which is positioned on the other half of the table.



Large auto body templets are machined automatically within 0.003-in. tolerance on contour dimensions at a cutting rate of 25 ipm. This special Cincinnati machine can handle templets up to 10 ft long by nearly 2 ft wide on a production basis

Finished templets check contours of wooden models of auto sections, in this case a car roof section. The three-dimensional wooden models serve as masters for dies used in producing actual car parts

It's not too late to beat foreign competition by . . .

Stabilizing wages and reducing costs

The only way for manufacturers to meet foreign competition in home markets is to get their costs down to a point at which they can offer competitive values, Alan C Mattison, president Mattison Machine Works, told members of the National Machine Tool Builders Association in his presidential address at the spring meeting at the Hotel Roosevelt, New York City, May 5-6.

Costs should be stabilized and technology transformed into lower prices, he said. It is not too late to do this. And the key to it is to stabilize wages and stop passing on to labor all of the benefits of increased productivity gained by technological advances.

"We have been talking glibly as to how higher wages have raised the standard of living," Mr. Mattison asserted. "But if, when you install a new machine, at the same time you raise the wage rate to where it offsets the increase in productivity, nothing has been done for the consumer. Instead of reducing costs, you have increased them. Prices go up instead of down. Rather than adding to purchasing power, you have fomented inflation."

If the practice is stopped of passing along to labor all of the benefits of increased productivity, "we can regain our competitive position," Mr. Mattison declared. "Our job is to convince U S metalworking manufacturers to modernize in order to survive and to meet the threat of foreign competition. The best way to do that is to persuade them to come in person to the Machine Tool Exposition—1960 (at the International Amphitheatre, Chicago, next September 6-16) and see the cost-saving potentialities of the machines displayed."

With the new and advanced machines exhibited at Chicago, metalworking management should be able to regain control over costs and once again be able to offer better things to more people at lower prices.

"Here at home we must take our own medicine," Mr Mattison declared. "We should be the first to modernize and to endeavor to transform technology into better values for the customers. Our best method, and the traditional one, of meeting the threat of foreign imports is that of outdesigning our foreign competitors. Demonstrating the superiority of American machine tool design will be one of the important uses of the Chicago Exposition."

Mr Mattison stressed the fact that increases in productivity in recent years have been due almost entirely to advances in technology—to the development of machines and equipment that mean greater output per man per hour. It is a fallacy to attribute these increases to labor.

As matters now stand, 124 NMTBA members will be exhibiting at the Machine Tool Exposition in September, Donald H McIver, chairman Exposition Committee and vice president Ex-Cell-O Corp, said. About 1050 machine tools will be displayed in 320,000 sq ft of space.

Arrangements have been made for the Conrad Hilton Hotel staff to operate a giant cafeteria seating 1200 people on the second floor of North Hall, Mr. McIver revealed, thus solving a food problem that has seriously plagued previous expositions. He urged machine tool customers to make room reservations at Chicago early, Chicago hotels having pledged 14,000 rooms. Bus service will operate regularly from the International Amphitheater to Midway and O'Hare airports.

Machine tool users seek builders' help in standardizing work areas

A group of machine tool users championing the standardization of certain working areas of general-purpose machine tools presented to NMTBA members a condensation of the proposals that they had made in greater detail at a meeting in Detroit on March 22. The group was headed by Robert L Witsche of the International Harvester Co and included H C Daum, Ford Motor Co; J Q Holmes, General Motors; V A Williams, Chrysler; A H Braadh, John Deere; and D J Reale, International Business Machines. (For complete report of the group's proposals, see *AM/MM* — April 4, '60, p133.)

Standardization is being sought in four types of general-purpose machine tools: drilling, turning, grinding and milling. A working committee would be set up in each of these categories on the basis of three representatives of the users' group, three of machine tool builders, and three of the Department of Defense. In the representation from the machine tool industry, two members would be chosen from the NMTBA membership and one from a non-member firm. Each working committee then would select a chairman who would be a member of a top coordinating committee.

The working committees, it is hoped, will be ready to start work by June 1 and will complete their work within six months. Final completion of the standardization program, if the users' group has its way, might be within five years.

The user group wants to establish information in two categories: (1) code for standard-size designation, motor hp and rpm, and minimum number and range of speeds, and (2) specifications for tooling-area dimensions, T-slot size and spacing, taper, fixture guide rail, working areas of tables, actual swing and between center distances. For movements, the users want to know minimums, for speed and feed ranges they do not want alterations that would affect present setups and allotted times, because such changes would re-open negotiations on labor standards.

At the presentation on May 5, the users' group unfortunately created the impression that it was attempting to high-pressure the builders into acceptance of their proposals on a "crash" basis, time being all-important. The Defense Department's enthusiastic endorsement of the proposals was pointed out, defense agencies being the largest buyers of general-purpose machine tools. The spokesman for the users' group made plain the fact that the group could write adequate standards immediately, but sought builders' representation on the committees.

The criticism over the presentation by the users' group was so great, however, that Mr Witsche, at his own request, appeared before NMTBA members the following day

to try to dispel certain impressions that he may have given the day before. He made crystal-clear the fact that the users' group has no thought of pressuring the builders but wants to work closely with builders in getting the best possible standards.

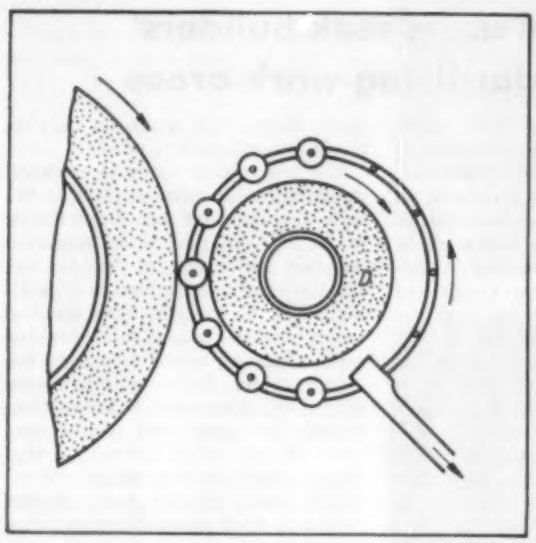
Mr Witsche said that if anyone got the impression that he had used the threat of purchasing foreign machines if U S builders did not go along with the standardization program, he wished to correct that impression. He declared that purchase of U S machine tools is the users' group's first consideration and that it feels that the proposed standards would help U S builders compete better against foreign machines. He likewise stressed that he had no intention of taking a dictatorial attitude in making his presentation, and if he gave such an impression, he wanted to apologize for it.

Boeing offers N/C programming service

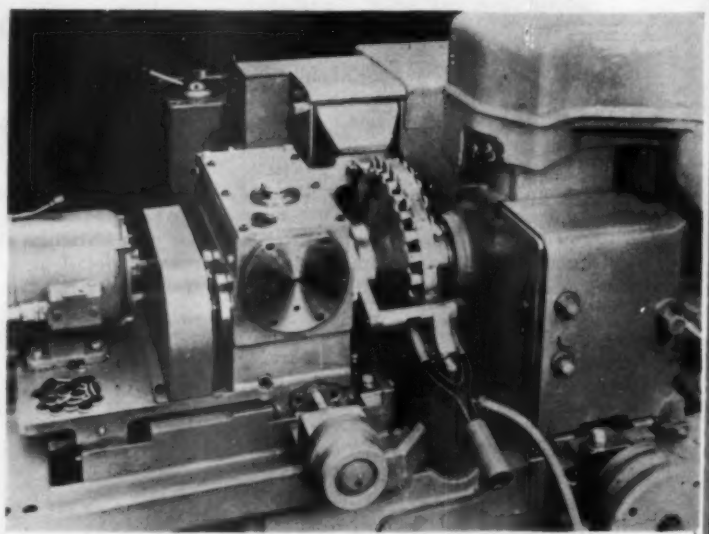
Services in all phases of numerical control are being offered by a new service established in Wichita, Kansas, by Boeing Airplane Co. Called Boeing Applied Computing Services, the organization will draw on the broad Boeing experience in numerical control to provide a computer center for all industry. Its primary purpose is machine programming of parts, tools, dies, and templets plus complete preparation of tapes for numerically controlled machine tools. Consulting service and personnel training in numerical control are also part of the BACS activity.

In addition to the programming services, actual production of parts on a contract basis with numerically controlled machines will be available. Product design, simulation studies, feasibility analysis, advanced calculations, and other studies requiring computers and data processing are part of the service.

Being comparatively simple and easy to use, the Boeing technique relies on experienced machinists and tool planners, rather than engineers or computer specialists, to do the part programming. Solving all computing data, even equations involving analytical geometry and calculus, is done on large IBM 705 computers. The BACS program is managed by Robert C Wilburn, who has been instrumental in setting up Boeing's advanced numerical-control program. Availability of this service to companies, regardless of size, is expected to expedite the use of numerically controlled processes.



Schematic arrangement of eccentric carrier (exaggerated), showing location of discharge chute



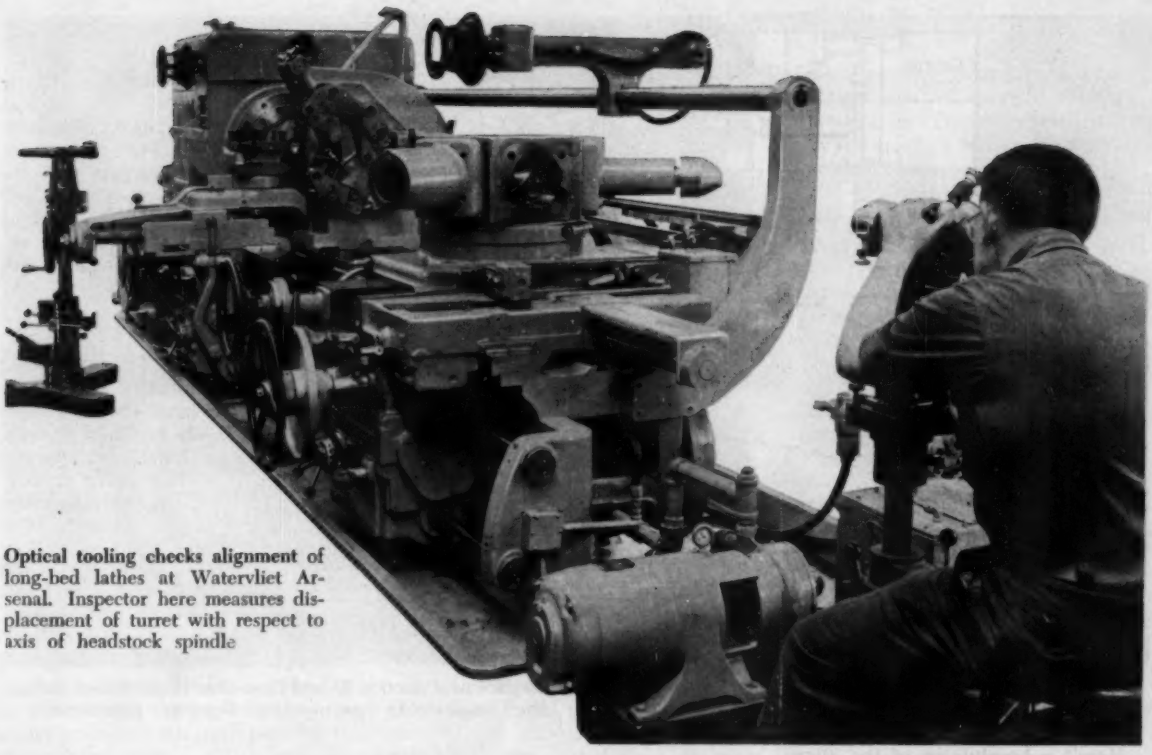
Eccentric loader installed on Scrivener centerless grinder makes fast work of finishing counter wheels

Eccentric carrier feeds centerless grinder

Finishing of number wheels for counters, computers, and similar equipment is simplified by an ingenious eccentric work carrier applied to a centerless grinder. The wheels are molded of black plastic, with the numbers impressed on the surface and filled in with white paint. To avoid a tedious wiping operation, the wheels are sprayed over their entire periphery and allowed to dry. Then the OD is ground to remove surplus paint, finish the part to size and, at the same time, insure concentricity between the outside diameter and the center hole of the wheel.

The carrier shown in the accompanying illustrations was developed by Arthur Scrivener Ltd, England, for this purpose. It consists of a steel ring with a row of pins on each edge, on which the rollers are placed, and is driven by a separate motor. It surrounds the regulating wheel but is mounted slightly eccentric. Rollers are loaded on the pins at a point farthest from the regulating wheel where, because of the eccentricity, there is ample space. The ring then carries the work around to the grinding position approximately level with the axis of the grinding wheel, at which point it contacts, and is controlled by, the regulating wheel.

During passage between grinding and regulating wheels, the surplus paint is removed and the OD is sized, stock removal varying up to 0.018 in. Parts remain on the pins until the carrier has made about one-third of a revolution beyond the wheel, when each pair of parts is removed by a jet of air and drops into a discharge chute. Production is at the rate of 4000 parts per hr.



Optical tooling checks alignment of long-bed lathes at Watervliet Arsenal. Inspector here measures displacement of turret with respect to axis of headstock spindle

Lining up the long ones

Optical alignment is faster and more accurate — especially on long-bed machines. That's the experience of the Watervliet Arsenal, which has some of the toughest alignment problems in Metalworking.

The longer a machine bed, the greater the alignment worries. When the machine is a precision gun-boring lathe, with a bed as long as 200 feet, misalignment of a few thousandths of an inch can send a gun barrel to the scrap heap.

At the Arsenal (outside Albany, NY) bed alignment is a constant production problem. Here the Ordnance Corps of the Army does the basic research and design on all its cannon. In an emergency, the Arsenal must be ready to go into full production of precision-bored gun barrels.

Here's the kind of accuracy that one Watervliet product must maintain: The Army's 280-mm atomic cannon must lob a ½-ton projectile over 20 miles and hit a target with pinpoint accuracy. That's precision firing of the first order, but manufacturing the cannon calls for even greater accuracy.

Solving alignment problems

Watervliet's cure for alignment headaches: optical tooling, which usually is more accurate—also faster—than mechanical tooling, especially on long-bed machines. Here inspectors don't have to rely on a mechanical fit, and beds don't have to be painstakingly leveled before alignment tooling can be set up. With optics, gravity (an important factor in mechanical inspection) doesn't have to enter the picture.

Thanks to some recent refinements in its optical setup, the Arsenal has simplified the job of getting the accuracy of bed alignment it needs. Engineers of the Keuffel and Esser Company's Optics and Metrology Div (Hoboken, NJ) discussed the problems with Watervliet's alignment experts, then designed special equipment for the Arsenal.

With the following equipment—all of it made by K & E—Watervliet can check the alignment of just about any long-bed machine tool:

- One alignment telescope
- One jig transit
- One "perfect cube" target that fits onto the headstock spindle
- One mounted plano - parallel mirror target
- One optical tooling scale on the lathe cross-slide or turret

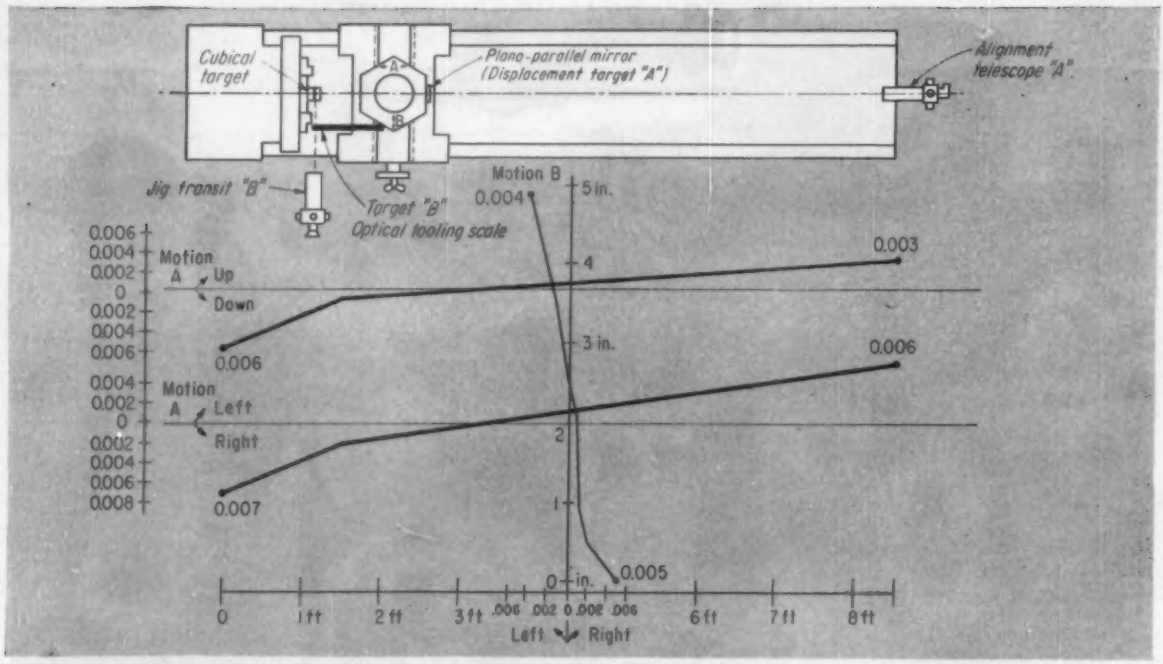
This equipment permits alignment procedures (described below) that give the Arsenal extremely close tolerances, considering the length of the machine beds. On one gun-boring lathe, for example, total cumulative error of ways recently was held to within 0.0025 in. (up and down, right and left) in 55 feet. According to Floyd Hill, Foreman of the Repair and Rehabilitation Unit that did the job, tolerances could have been even closer if they had been required.

Visitors at the Arsenal can't help being impressed by the row of monster lathes that stretch across the machining bay. Floyd Hill calls them his "wow" machines, and the description is apt: The largest "wow" is a gun-boring lathe with a 10-ft faceplate and a 200-ft-long bed.

But the Arsenal also has smaller machines that have to be aligned—machines more typical to other metalworking plants. And the special optical equipment works just as well on these smaller units.

Typical application

One of the most interesting recent alignment jobs was on a Gisholt turret lathe that helps make the Army's 105-mm rifle. To profile bore the powder chamber, prior to cold work, the Arsenal uses a turret lathe (see photo) with 8½ feet of longitudinal turret travel.



Typical alignment graph shows displacement readings before alignment. These preliminary readings show longitudinal displacement (motion A) and cross-slide displacement (motion B). Text describes equipment and alignment procedures

Here's a breakdown of the alignment problem:

- Align bedways on the lathe—left and right, up and down—to within acceptable tolerances.
- Align revolving steady rest that supports the gun barrel, to make its center coaxial with the headstock spindle's (not shown in photos).
- Align cross-slide ways to make them perpendicular to the headstock spindle's axis (that is, to make cross-slide motion perpendicular to longitudinal motion).

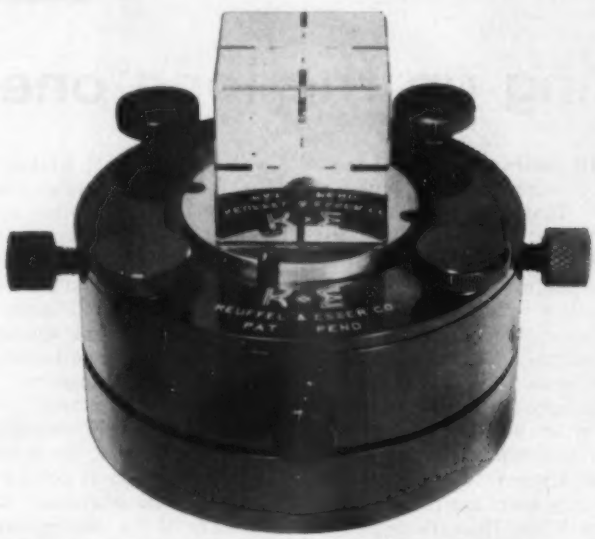
The result, with optics: Alignment within allowable tolerances in less than two hours. Final alignment of bed ways was within 0.002 in. over the entire longitudinal travel (8½ ft) of the turret carriage.

Optical setup

As the chart shows, one alignment telescope (K & E No. CN-9092-2) and one jig transit (K & E No. 9092-1A) are set up for the operation—one at the end of the lathe bed, the other at right angles to headstock spindle.

Of special interest is the glass-cube target that mounts in the headstock spindle, so that its center is coaxial with the spindle's axis. Mirrored on five sides, the cube was ground and polished to extremely fine tolerances by K & E's optical department: All face-to-face angles were held to within three seconds of arc.

The cube mounts in a metal plate that in turn mounts on the spindle.



"Perfect cube" target fits onto headstock spindle, its center coaxial with spindle's axis. Tolerances on this Keuffel and Esser "special" are extremely fine—all face-to-face angles are held to within 3 sec of arc

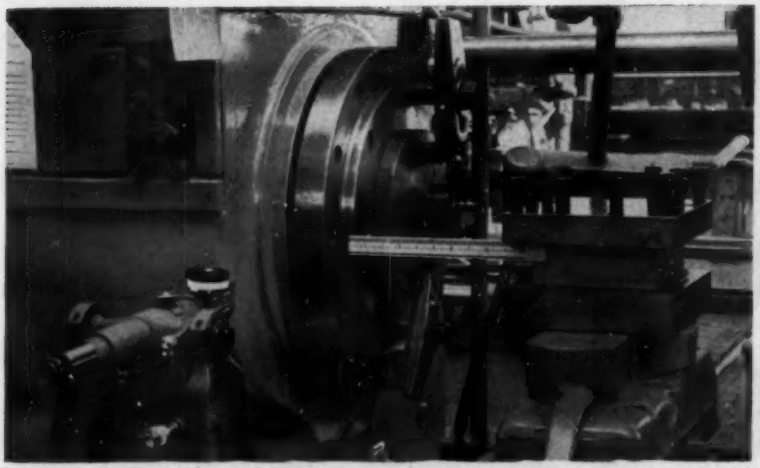
A special spring arrangement permits the cube to be tilted and translated (shifted up, down, and sideways).

Completing the optical setup is one displacement target—a glass disk mounted on the turret—and one optical tooling scale. Each of these mounts on the lathe turret, in the line of sight between the alignment scope, the jig transit, and the glass-cube target. The tooling scale, attached to the cross-slide, measures angular displacement of the turret cross-slide ways.

Measuring displacement

To set up the optical tooling that will check bed alignment, inspectors first mount the cube target in the headstock spindle. Line of sight (for longitudinal alignment) is from alignment scope "A" through the turret to the cube (see chart).

This line of sight must be coaxial with the spindle axis. Therefore the



Turret cross-slide ways are checked with jig transit, displacement scale, and "perfect cube" target mounted on headstock spindle

spindle (and the cube) is rotated and the cube is tilted and/or translated until it is properly lined up. This technique orients the cube to the spindle and aligns the scope with the cube. The result is that the line of sight—from scope to cube—becomes coaxial with, and parallel to, the spindle's axis.

Now displacement target "A" is mounted on the turret (positioned at the head end of the bed) and centered in the line of sight. Once this setup is completed, measurements can begin.

The inspector moves the turret along the bed and takes readings at equal intervals. Transferred to a chart, these readings are plotted as graphs that show the displacement —right and left, up and down—of the turret at any point along the bed. In other words, the graphs show the displacement of the turret caused by errors in bed alignment.

To check the turret cross-slide ways, the Arsenal uses a similar procedure. Jig transit "B" is aligned with the cube target (see chart). Displacement scale "B," held to the cross-slide, is aligned with the line of sight between scope and cube. Readings taken at intervals along the cross-slide produce a graph that shows displacement of cross-slide motion at right angles to longitudinal motion.

This first graph shows the exact amount of error in all directions of travel. When adjustments have been made to remove these errors, inspectors take another series of readings. This procedure continues until alignment errors fall within acceptable tolerance limits.

Excellent Results

Watervliet has found that its optical tooling produces quick, accurate results on many types of machines. Here's one more example: To align the 37-ft-long V-ways on a grinder, the optical tooling took only two hours; total cumulative error was held to 0.002 in. in 37 ft.

On a smaller machine, mechanical devices might have done the job just as quickly and accurately. But big machines with long beds are a different matter.

Sometimes mechanical devices simply won't work. A few giant boring lathes, for instance, have four carriages. Here mechanical devices can't align the carriage cross-slide relative to the spindle axis, because the third and fourth carriage can't be positioned close enough to the spindle. Here optics have to be used.

One more alignment technique at Watervliet deserves mention: If experiments now being held are successful, a TV camera may replace the human who peers through the alignment telescope. The image from the camera will be transmitted to a monitor located alongside the ways of the machine being checked. Thus an inspector can see the amount of misalignment while he is making adjustments to correct it.

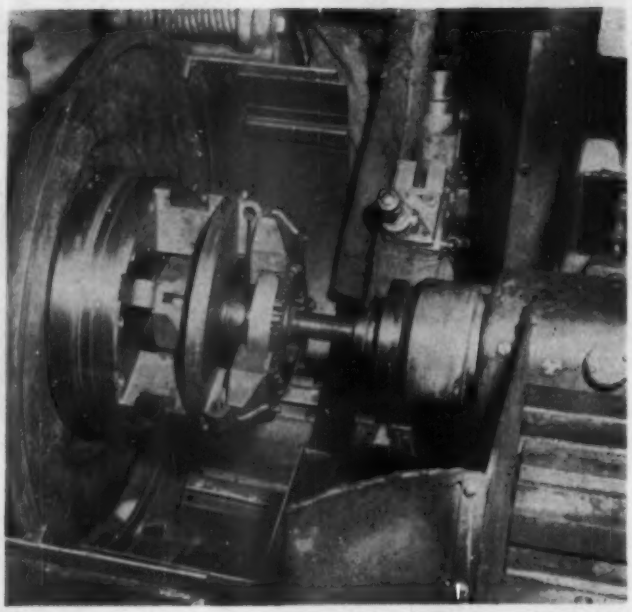
Plotter-verifier "dry runs" tapes that control machines

It costs a lot of money to check the accuracy and workability of numerical control tapes by putting them to the test on an actual machine tool. But now Boeing Airplane Co, Wichita, Kan, has come up with an electronically controlled, continuous-path plotter-verifier, which prescribes the cutter center path for two- and three-dimensional production parts.

The Boeing machine (photo) has a table simulating a machine bed. A ball point pen duplicates the center cutter line's axial movement with relation to the setup point. The part is thus drawn on paper in three views, using any two axes simultaneously. Views can be measured to a tolerance of ±0.005 in. on Boeing's prototype, and plans are under way for an improved plotter-verifier which will be accurate to within ±0.0025, and which will receive its input data directly from computers.

By showing up errors on control tapes that may have resulted in processing, *before* the tapes are tried out on a production machine itself, Boeing claims this development is a major improvement over the usual method of testing tapes with a stylus mounted on the machining spindle to trace the cutter path.

SPRING-JAW CHUCK puts the squeeze on cluster gears



Tooling for precision gear grinding costs real money. This is okay when a production run is big enough to absorb the cost. But it's a different story when the run is short. Then, some real figuring is needed to hold tooling costs down to a point where they don't take a gouge out of ultimate profits.

A case in point: production of cluster gears. Here, product quality depends upon concentricity between individual gears—and tooling precision is vital.

So is economy.

Tooling up for the gears to go into a new tractor transmission, Allis-Chalmer's Springfield, Ill, plant tool engineers ran up against tough precision-holding problems.

For instance, the final operation in finishing the gears—grinding the ID—is of prime importance, because the operation of the gear is governed by accuracy of the bore. This in turn depends upon (1) how accurately the gear teeth have been formed, and concentricity between the two rows of teeth, (2) how well heat-treat distortion is controlled, and (3) how well the chuck accommodates these inaccuracies when centering.

Pitch diameter for one of the gears must be held as close as 0.0025 in., for the other 0.0045 in. To obtain these accuracies, Allis-Chalmers selected a spring-jaw chuck that not only holds gears for boring, but which can be used for holding the two different gears. In effect, the spring-jaw chuck, manufactured by Erickson Tool Co of Cleveland, does the work with greater accuracy than a sliding-jaw chuck, and at a cost considerably less than that of a double-diaphragm chuck—two alternate methods of holding cluster gears.

About the gears themselves: one has 27 teeth at one end, 15 at the other. Both pitch circles must be concentric with the inside diameter within 0.004 TIR. The other gear has a 27-tooth gear at the large end, and a 27-tooth spline at the other. The 27-tooth gear on both the cluster and the splined gear has a pitch diameter of 4.5000 in. However, the pitch diameter of the 15-tooth gear is 2.5000 in., and the spline has a pitch diameter of 2.8750 in.

Grinding the ID

After the teeth have been hobbed, the parts carburized, case-hardened and cleaned, the parts are ready for final machining—grinding the inside diameter. In this operation about 0.020 in. is removed.

The bore on the splined gear must be held between 2.233 and 2.235 in., and the bore on the cluster gear between 1.4987 and 1.4994 in.

For similar jobs in the past, Allis-Chalmers often used sliding-jaw chucks, but these required considerable setup time, and were expensive to maintain to the desired degree of accuracy.

Double-diaphragm chucks, which hold gears by gripping them on the pitch diameter of both rows of teeth, were also used by Allis-Chalmers. These chucks easily obtained the required concentricity and accuracy, but were expensive.

The new spring-jaw chuck combines the good features of both the sliding-jaw and double-diaphragm chuck, but costs only about two-thirds as much as the latter.

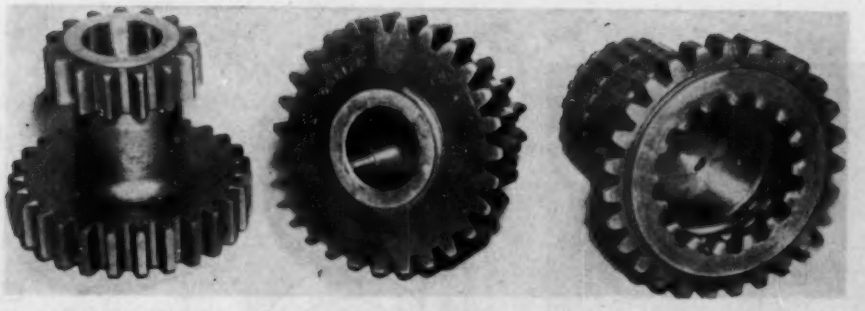
To insure accurate gear alignment, several design features have been incorporated into the spring-jaw chuck. For instance, the balls that clamp the gear are made of carbide. These clamps are held tightly in a spring cage, which is thick around the clamps and thin and flexible between them. The clamps extend through the cage and are held flush against the master jaw of the chuck.

Pressure applied to the master jaws is transmitted to the three clamping balls holding the gear. The master jaws are ground under pressure to insure concentricity when holding gears under pressure.

Two spring cages, each with three clamps, are used—one for each gear on the cluster. All of the clamping force that holds the gear comes from these six clamping balls.

The two spring cages can rotate in relation to each other, thus accommodating any variations in alignment between the teeth of the two gears on the cluster. When the master jaws close, forcing the clamps against the teeth, the clamps seat firmly between the teeth. Any variation in tooth form is accommodated by the spring cage, which bends to allow the balls to seat firmly.

Still other cluster gears could be held by the chuck, simply by changing the spring cages (as long as the



distance between two rows of gear teeth is not greater than that between tow rows of clamps).

Locators, which vary with the length of the gear, position the gears so that their teeth meet the ball clamps.

When the ground gear is removed and a new one placed in the chuck, the air is turned off and tension in the springs causes them to close, forcing the push cup, pins and piston back to their original position. As the springs close, they tighten the clamping balls against the gear, forcing the end of the gear tightly against the locating ring (which is mounted at the base of the gear and separated from the chuck by a Neoprene gasket). This gasket allows the clamping balls to center the part correctly, even though the gear end is 4 or 5 thousandths out of square. However, Allis-Chalmers requires that its gears be held to closer tolerances than this.

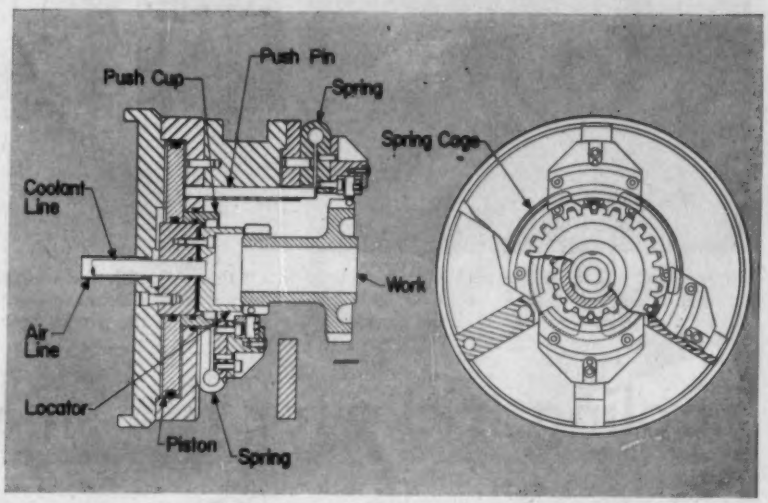
The spring-jaw chuck has an opening and closing range of more than 50 thousandths, yet still maintains accuracy (a diaphragm chuck can only open 10 thousandths and maintain accuracy), and the gripping power of the spring-jaw chuck is constant over the entire range of openings.

When both pitch diameters of the gear held by the chuck are true circles and concentric with each other, the chuck will hold the bore concentric within 0.0002 TIR. Obviously, however, pitch diameters are not always concentric, so the chuck gives the possible setup between the two pitch diameters.

Heat treating also causes some gear distortion, but the six gear-gripping ball clamps can move slightly to overcome local distortions so that they average out. Too, gears run more quietly because the bores are held more nearly concentric with pitch diameters.

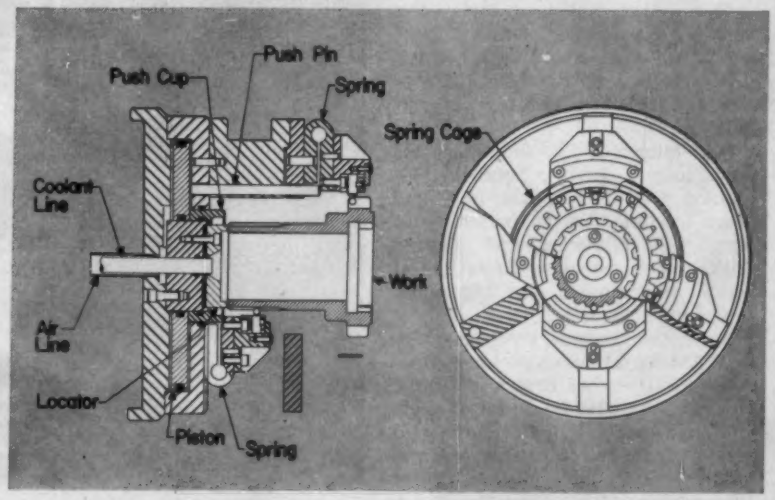
Coolant is brought to the part by a pipe inside the air line. By entering at the inside of the chuck, the coolant washes the grinding abrasive and chips out of the gear and chuck, instead of back into them.

Chuck holds cluster gear . . .

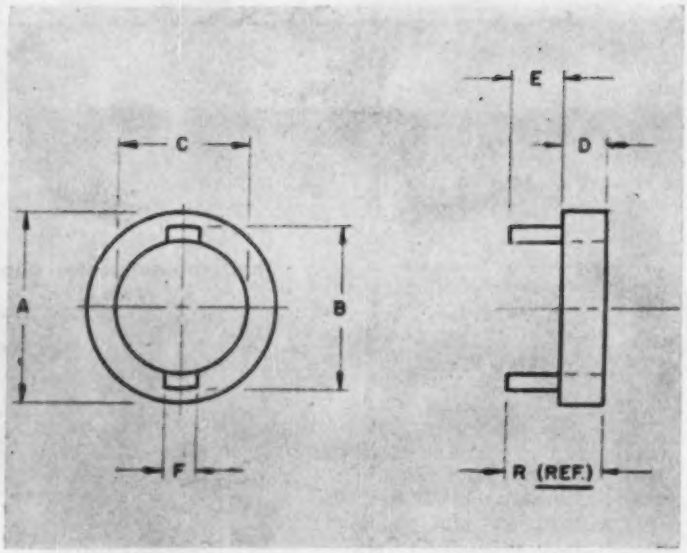


Spring-jaw chuck holds a cluster gear for grinding by clamping on the gear teeth with carbide balls. Each gear is held by three clamps mounted in a spring cage, which is thick around the clamps and flexible between to allow the clamps to adjust to distortion in heat treating. Spring cages, one for each gear, accommodate variations in tooth alignment between the two gears on the cluster

. . . and with a simple change of the spring cage holds a spline gear



By changing the inside spring cage, the spring-jaw chuck can also be made to hold the splined gear. Chuck is operated by air, which enters at its center, pushing the piston to the right, thus opening springs on which master jaws are mounted. When master jaws open, pressure on ball clamps releases and gear is freed



High speed and a long travel are characteristics of this straddle milling attachment for producing legs on a variety of stainless steel. Mechanical throw of a cam is combined with the stroke of an air cylinder to produce the required slide movement. Drilling, reaming and milling is done before the part is separated from the bar

Tooling tricks for the small shop

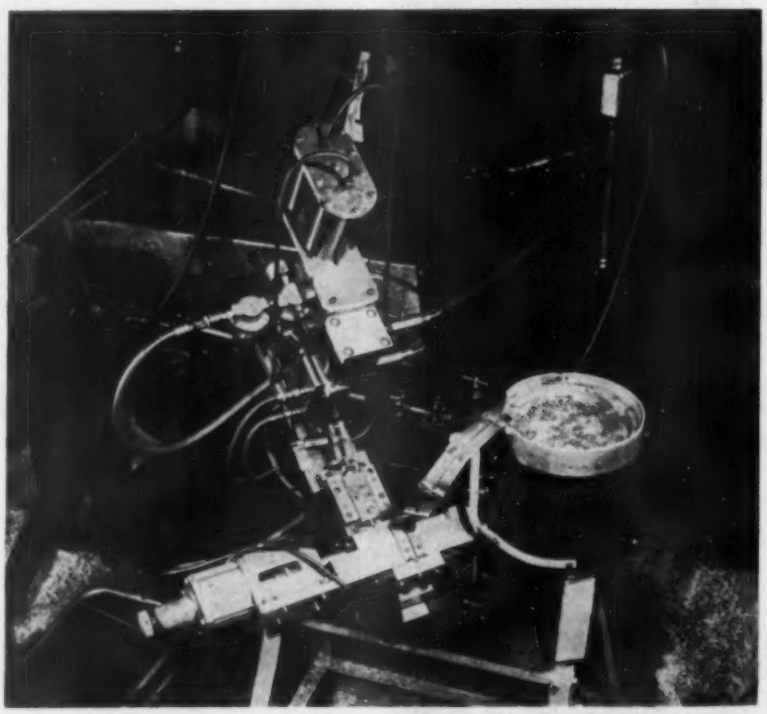
A lot of manufacturing tricks are needed to turn a profit in the small job shop, where competition is keen, jobs run the gamut from short runs to high-volume production, and practically every order is marked "rush rush."

Tough jobs are the rule, rather than the exception. Getting out a good job at a good price on a tight schedule takes spur-of-the-moment ingenuity—the same kind of thing they used to call "flying by the seat of your pants" in the early days of aviation.

One Michigan job shop has this down to a T. Lattner Brothers Machining Co at Ferndale over the years has piled up an inventory of home-made fixtures and tooling tricks to cut costs on wide variety of screw machining, drilling, and broaching jobs.

Take, for instance, screw machining. Among its automatic screw machines, Lattner has Brown & Sharpe OOG's, OG's, and 2-G's, all of them equipped with shop-designed special attachments for maximum machine flexibility and interchange of jobs among machines.

One OOG has a straddle milling attachment specifically designed for milling stainless steel rings which lock threaded insert bushings and



Coining and broaching are combined in this home-made setup—"key rings" are automatically delivered to a set of coining dies from a vibratory feeder, in the correct position for leg widths, and for broaching the ID. Coining dies are solenoid operated. Broaching is done with a hydraulic cylinder. Broach extraction and automatic part ejection are both done by air pressure

studs into place in aircraft, hydraulic, electronic and other applications where vibration tends to dislodge fasteners. The rings (Kelox key rings) range in size from 1½-in. OD down to ⅛ in. All are made from 416 stainless steel bar stock.

Lattner admits less chips would be wasted by using tubing, but it finds machining the rings from bar works best. The bar stock is extra special, however. Supplied by Jones & Laughlin, it is treated for uniform grain structure and a consistent hardness of 22 to 28 Rockwell C, and is consequently more satisfactory than tubing or the cold-draw stainless once used. Lattner now estimate's production has increased 20% over what it was, because rejects and downtime have lessened as tool life increased.

Screw machine operations on the rings begin with feeding a 12-ft bar to a stop for facing, centering, combination drilling and turning, reaming and shaving. The spindle stops while the part is held on a collet for straddle milling two legs (or keys) diametrically opposite each other. The spindle is then actuated again for reaming, shaving and cut-off. The milling attachment is mounted on a compound triple slide, which is cam and air actuated, to attain the required length and speed of travel.

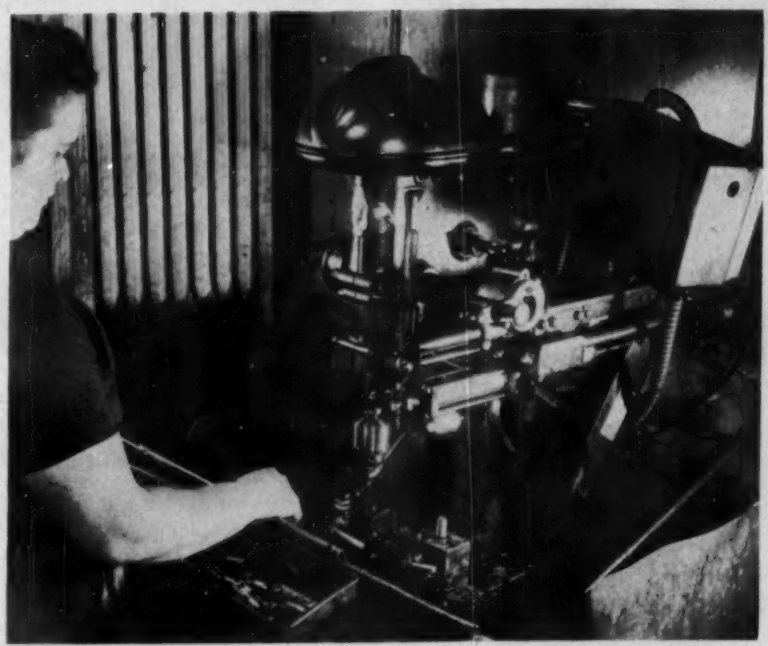
This combination moves the cutters into and out of position during the milling cycle without interfering with the turret swing stop, or with the overhead and rear slide, upon which additional tools are mounted.

After milling, the OD of the part is turned with a knee tool and the ring is cut off. Thin wall sections, irregular geometry, and relatively close tolerance make it too difficult to hold these pieces once they've been cut off. Consequently, milling and the other operations are performed before separating the ring from the bar. Depending upon size, machining ring in one of the Brown & Sharpe setups takes from six to 60 seconds.

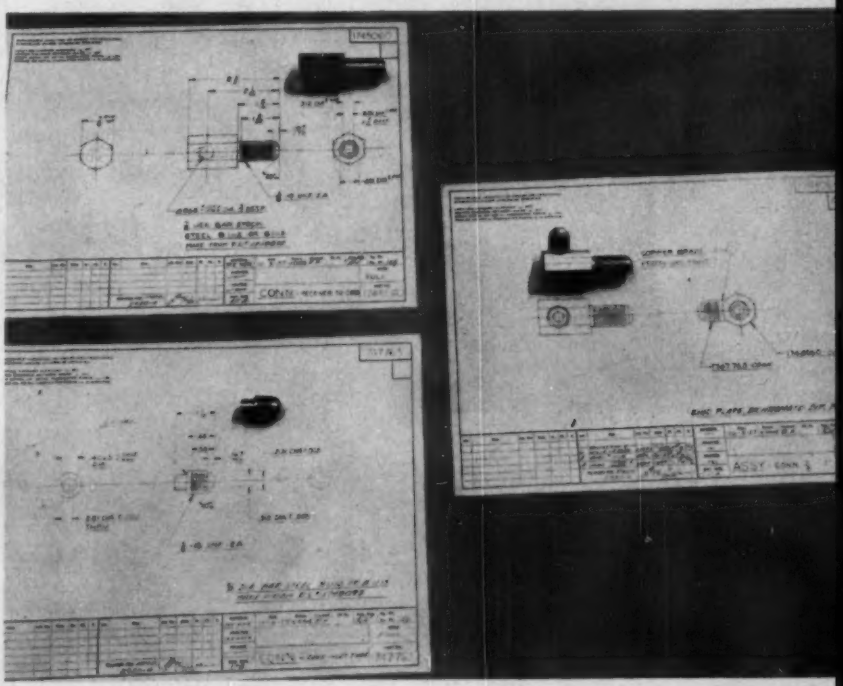
Coining and broaching setup

An ingenious setup for coining and broaching the key rings after these operations is built around a standard Black and Webster Electro-Punch, an air-hydraulic system, and a Syntron vibratory hopper feeder. In this setup, the rings are coined to hold flatness dimensions and to maintain leg widths within plus zero, minus 0.005-in. The ID of the legs (and ring) is broached to the same dimensional tolerance and to

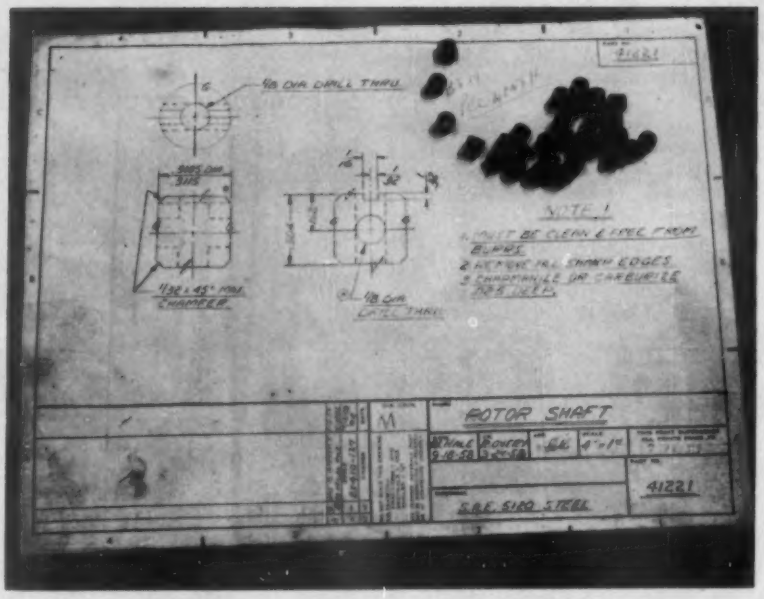
Secondary screw machine operations . . .



Simple screw machine setup shown above performs secondary operations quickly and accurately. A 0.281 inch-diameter hole, 2-5/16 inches deep (photo below) is automatically reamed in a hex-shaped connector on one fixture while a second fixture is loaded. The table travels automatically, bringing one fixture under a stationary Delta head for the operation while the other is unloaded and loaded. Two other fixtures are employed to produce the cross-hole in exactly the same way



Cross-holes are drilled and burred in small parts at a rate of 600 to 700 an hour in this air-operated setup. Cycling of both drill heads is automatic, after the small rotor shaft has been located and clamped in the fixture



Tooling Tricks (Continued)

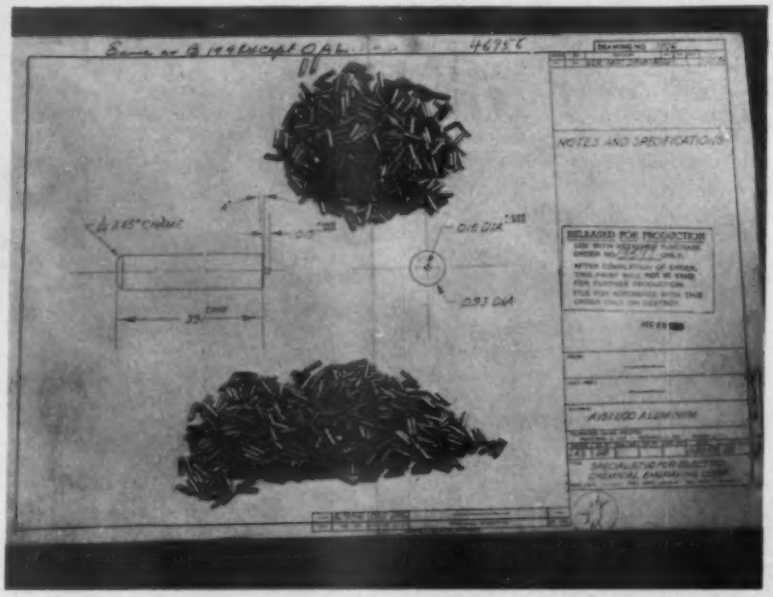
hold concentricity within 0.002-in. TIR. Rings are automatically oriented and fed to a set of coining dies actuated by the Electro-Punch. After coining, while the rings are still nested for this operation, a hydraulically-actuated broach engages the ID. Production reaches thousands of units per hour.

Drillpress setup

Another home-made setup that pays off involves nothing more complicated than a standard single-spindle Delta drill press and a hydraulically operated reciprocating table. Two fixtures on the table allow an operator to load and unload one while the other is under the drill. An air cylinder actuates the drill head through an automatic cycle. With this setup, cross-holes are produced in hexagon-shaped connectors at high production rates.

A somewhat similar arrangement makes use of another air-operated Delta head for drilling ⅛-in. cross-holes in small 5120 steel rotor shafts. Less than ⅜-in. square, these parts are located on a previously milled slot which engages a key in a fixture. Clamping is done automatically by an air cylinder. Cycling is also automatic—the operator merely loads and unloads the fixture. Reaming the drilled holes (part of the automatic cycle) is handled by another standard head on the same table.

One of the most unusual operations in the shop is "automatic" visual inspection of small aluminum welding studs that have been made on screw machines. With this setup, chips, scrap, and small particles are removed from the studs while they are visually checked for burrs, breaks or damaged tips. The operator views the parts under a 4-power lens and a light as they travel along a vibrating chute. Automatically fed to the chute from a Syntron feeder, the parts are sufficiently agitated to shake loose all foreign matter, which falls through the chute into a container as the work moves on to fall into tote pans at the end of the chute. In this way, thousands of parts are checked in an hour—and no scrap is shipped with the production.

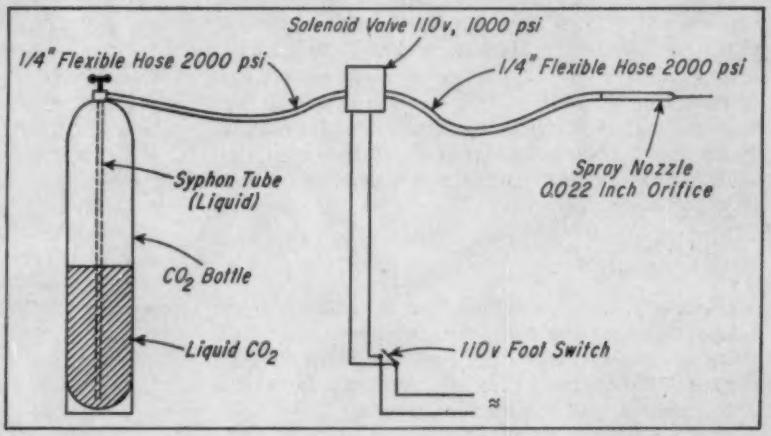


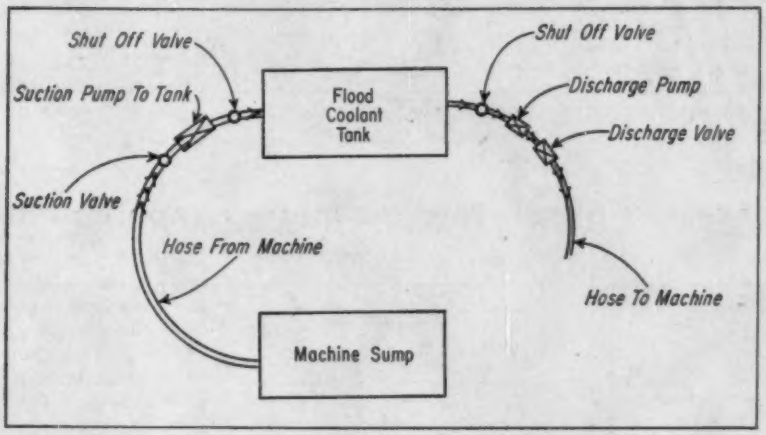
One operation replaces four in visual inspection of these tiny welding studs, which are made on screw machines. An automatic feeder, vibrating chute, light, and a 4-power lens simplify what was once a long, tedious operation. All chips, scrap, and screw machine particles are shaken loose while the parts are quickly being checked for flaws

SUB-ZERO MACHINING

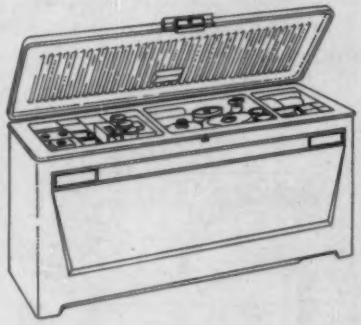
CO_2 mist cooling (–109 F) has improved tool life as much as 300% in machining super steels

Sub-zero flooding (–76 F) has been especially successful in turning and drilling superalloys





Less effective and more expensive: deepfreezing the work itself



By F A Monahan, manager
Manufacturing Division and
Process Specifications
Convair, a Division of
General Dynamics Corp
San Diego, Calif

in cooperation with:

WRIGHT-PATTERSON AFB
Manufacturing Methods Division
Aeronautical Systems Center
Col Preston L Hill, chief
M A Guenther, senior project engineer
Robert T Krueck, project engineer

Superalloys are here to stay. The job of machining them is today almost exclusively the province of the aircraft and missile industry. Yet one day they will be common shop materials. Toughest problem to lick is the terrific heat (up to 2000 F) generated at the tool-work interface. Obviously, machining temperatures must be brought down if accuracies are to be maintained. Here are the results of the most comprehensive sub-zero machining tests ever undertaken

American Machinist / *Metalworking Manufacturing* Special Report No. 489 · May 16, 1960

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SUB-ZERO MACHINING

The job of machining ultra-tough superalloys lies somewhere in the future for most shops, but to the aircraft and missiles industry, it is a problem that must be licked *today*.

Under ordinary conditions, machining of these super steels creates temperatures as high as 2000 F at the point of contact between tool and work. That's a lot of heat in any metalworking league—enough to melt copper, and nearly twice the heat required to heat-treat ordinary alloy steels. Result: galling, seizing, work-hardening, low-temperature oxidation —all unwanted end products of a combination of heat and compression.

Heat is the problem

Obviously, then, something has to be done to get temperatures at the tool-work interface down to a point where superalloys can be machined with some degree of the accuracy that is so vital to today's missiles, rockets, and supersonic aircraft.

There are three ways to do it:

- Surround the work area with cold (—109 F) mist.
- Flood the area with dry-iced coolant (—76 F).
- Deepfreeze the part itself.

Sub-zero machining has been done before, but never on such a scale as Convair has undertaken in tests for the Air Materiel Command.

All three methods were tried out in turning, milling and drilling of five super alloys:

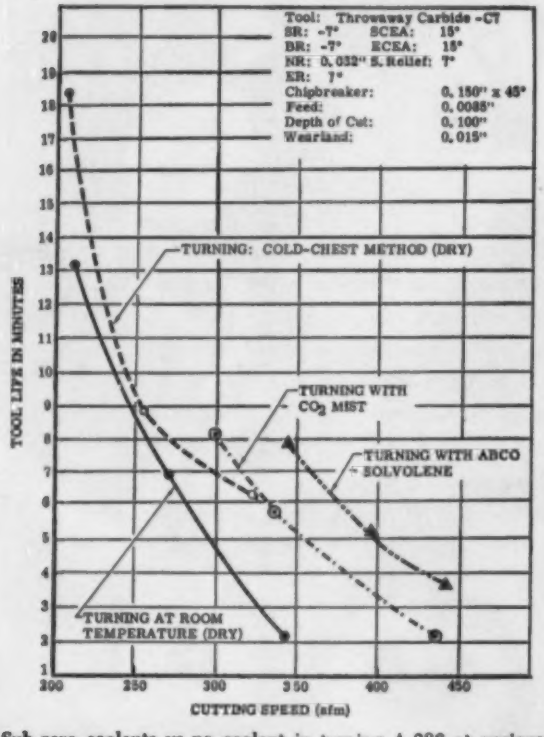
- Alleghany-Ludlum Corp's A-286, a heat and corrosion-resistant austenitic alloy with high work-hardening characteristics and resistance to oxidation similar to that of 310 stainless.
- Haynes-Stellite's L-605, a cobalt-base, high-temp, oxidation- and carburization-resistant alloy.
- Haynes-Stellite's R-235, a nickel-base, precipitation-hardening alloy.
- Vanadium-Alloys Steel Co's H-11, a high-strength, hot-work die steel.
- Climax Molybdenum Co's molybdenum-titanium (Mo-0.5% Ti) alloy—with high strength and corrosion resistance at elevated temperatures.

Machines for the tests were standards actually used in production at Convair.

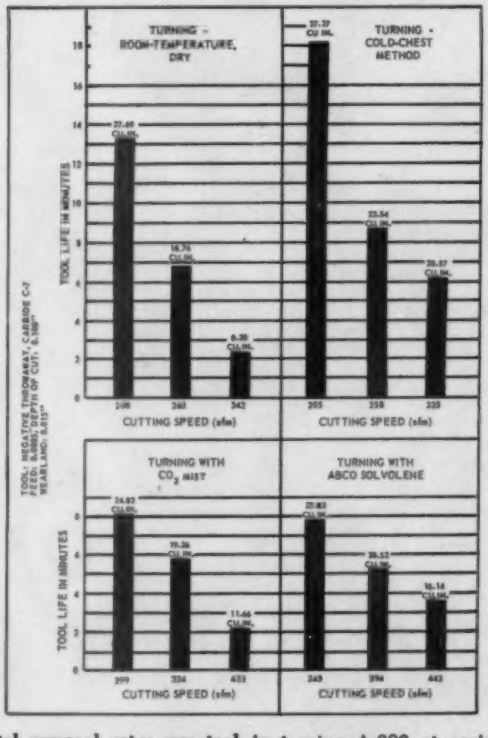
Primary purpose of the Convair-AMC tests: to develop equipment and techniques based on an evaluation of sub-zero machining critical materials.

What did come out of the tests? For one thing, they proved that the mist cooling and flooding methods are superior to the cool-the-part-itself method. For another, they proved that turning H-11 steel with a CO_2 mist improved tool life by as much as 300% over that obtained with conventional coolants. And end-milling of R-235 steel with CO_2 mist increased tool life 100%.

Test results of sub-zero machining experiments


Tool: Throwaway Carbide -CT
SR: -7° SCEA: 15°
BR: -7° ECEA: 15°
NR: 0, 032" S. Relief: 7°
ER: 7°
Chipbreaker: 0, 150" x 45°
Feed: 0, 0085"
Depth of Cut: 0, 100"
Wearland: 0, 015"
TURNING: COLD-CHEST METHOD (DRY)
TURNING WITH CO2 MIST
TURNING WITH ABCO SOLVOLENE
TURNING AT ROOM TEMPERATURE (DRY)
TOOL LIFE IN MINUTES
CUTTING SPEED (sfm)

Sub-zero coolants vs no coolant in turning A-286 at various speeds. Best results: with sub-zero flood coolant



Metal removal rates per tool in turning A-286 at various speeds and with different coolants

Flooding the tool with refrigerated Solvolene produced similar results in turning L-605 and A-286 steels, and in drilling L-605 and R-235. In these operations, cutting speeds were achieved beyond those practical with room-temperature coolants.

Admittedly, sub-zero machining techniques have not been successful in all the Convair tests, but a start has been made toward improving the art.

Let us first look at the problems of machining superalloys. Foremost of these is the great heat that is generated at the tool-work interface.

This is the greatest factor affecting tool life. It comes very close to the maximum temperatures that a tool can withstand and still cut. For this reason, cutting speeds must be reduced, under room-temperature machining conditions, to a point where production is seriously affected.

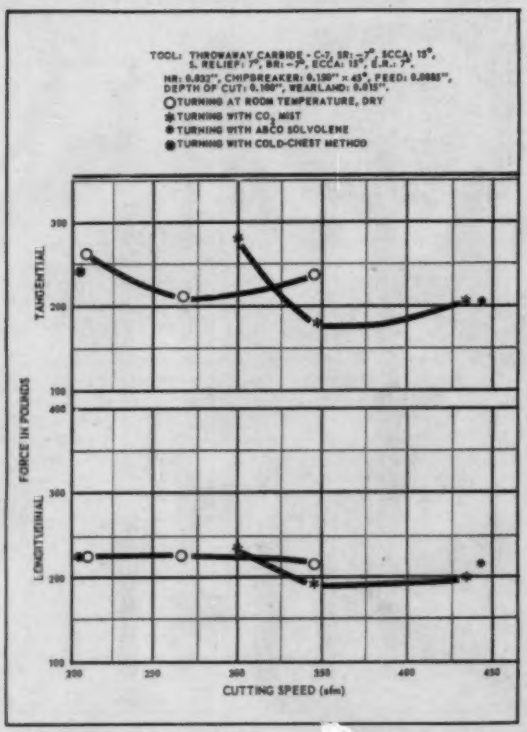
These lower machining speeds help prevent work hardening of these sensitive materials as tools wear. In this way, changes in microstructure are avoided, but the lower-speed method is limited by the narrow range of speeds and feeds available in most machine tools. For instance, most millers, lathes and drill-presses do not as a rule have low-speed changes close enough to permit optimum machining speeds with super steels.

Control over heat at the chip is least difficult in turning operations, where a continuous chip is

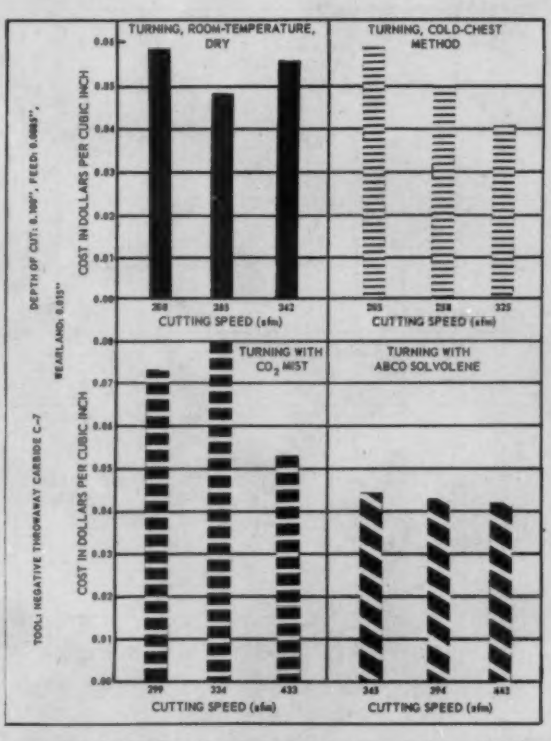
Chemical composition of metals machined in sub-zero tests

Alloying Elements	Percentage			Composition	
	A-286	L-605	R-235	H-11	Mo-0.5% Ti
C	0.08 Max.	0.15 Max.	0.16 Max.	0.37-0.43	
Mn	1.0-2.0	1.0-2.0	1.0 Max.	0.20-0.40	
Si	1.0 Max.	1.0 Max.	1.0 Max.	0.8-1.0	
Cr	13.5-16.0	19.0-21.0	14.7-17.0	4.75-5.25	
Ni	24.0-27.0	9.0-11.0	66.0		
Mo	1.0-1.5		4.5-6.5	1.2-1.4	99.5
Fe	BAL	3.0 Max	9.0-11.0	BAL	
Co		BAL	2.5 Max.		
Ti	1.75-2.25		2.25-2.75		0.5
V	0.1-0.5			0.4-0.6	
Al	0.35 Max.		1.75-2.25		
W	14.0-16.0				
S	0.04 Max.			0.03 Max.	
P	0.04 Max			0.03 Max.	

with A-286 (austenitic steel)


TOOL: THROWAWAY CARBIDE - C-7, SR: -7°, SCCA: 15°, S. RELIEF: 7°, BR: -7°, ECCA: 15°, E.R.: 7°,
NR: 0.032", CHIPBREAKER: 0.150" x 45°, FEED: 0.0085",
DEPTH OF CUT: 0.100", WEARLAND: 0.015".
○ TURNING AT ROOM TEMPERATURE, DRY
✱ TURNING WITH CO_2 MIST
✱ TURNING WITH ABCO SOLVOLENE
● TURNING WITH COLD-CHEST METHOD
TANGENTIAL
LONGITUDINAL
FORCE IN POUNDS
CUTTING SPEED (sfm)

Effect of various coolants and cutting speeds on tool forces in turning A-286


TURNING, ROOM-TEMPERATURE, DRY
TURNING, COLD-CHEST METHOD
TURNING WITH CO_2 MIST
TURNING WITH ABCO SOLVOLENE
COST IN DOLLARS PER CUBIC INCH
CUTTING SPEED (sfm)
DEPTH OF CUT: 0.100", FEED: 0.0085",
WEARLAND: 0.015"
TOOL: NEGATIVE THROWAWAY CARBIDE C-7

Cost of metal removal per cu in. turning with one cutting edge at various cutting speeds, with different coolants

formed, and where a nearly constant temperature can be maintained throughout the cut. Here, coolants can reduce the temperature still further, allowing for increased cutting speeds.

But control of heat is a lot more difficult in milling and similar operations involving interrupted cuts. Temperatures at the teeth of the cutting tool change constantly—in contact with the work a tooth becomes hot: when it is taken away it cools. This not only creates thermal shock, it frequently causes chips to weld to the tooth—and cutting edges chip.

Tendency of super alloys such as those used in the Convair tests to sieze, gall, work-harden and oxidize is attributable to heat and compression.

Heat expands the work

Heat up to 2000 F is conducted through the entire part as work progresses, causing it to expand enough to lose its close dimensional accuracy and — more important—to press against the tool, producing a burnishing effect.

Metallurgical structure of the part actually changes under such heat, and is usually quenched in this condition by conventional oil or water coolants. And while ordinary coolants do conduct heat away from the point of contact, they do so too slowly to be effective with sensitive super steels such as those used in the Air Materiel Command tests at Convair.

As a result, it is far more difficult to control heat in chips of these steels than in chips of more conventional steels.

CO_2 mist coolant

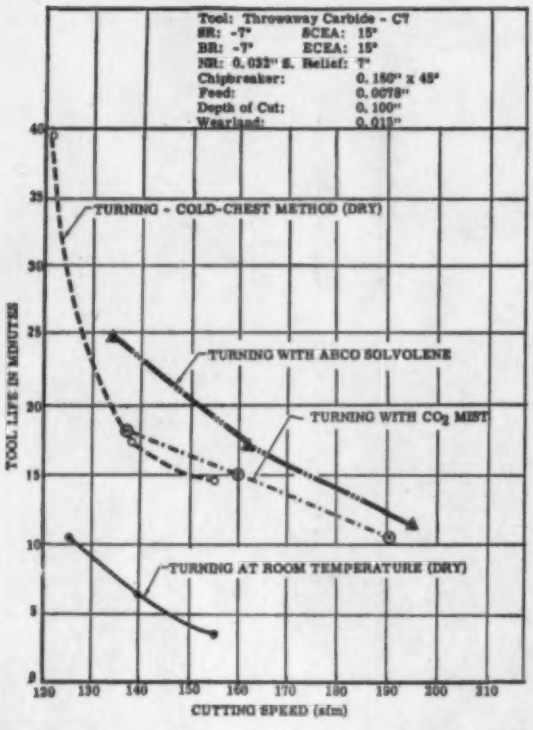
Working with sub-zero mist cooling, Convair directed a continuous measured supply of liquid carbon dioxide to the area of contact between the tool and the work through an 0.022-in.-diameter orifice. This diameter was established in preliminary test runs, when it was found that orifices any smaller than this wouldn't deliver enough CO_2. Larger orifices, on the other hand, used so much CO_2 that the slight increase in tool life achieved could not justify the added cost of coolant.

The 0.022-in.-diameter orifice, it was found, produced a steady flow of CO_2 at about 0.9 lb/min—producing a temperature of –74 C (-101 F) at the cutting edge of a single-point turning tool located 5/16 in. away from the orifice.

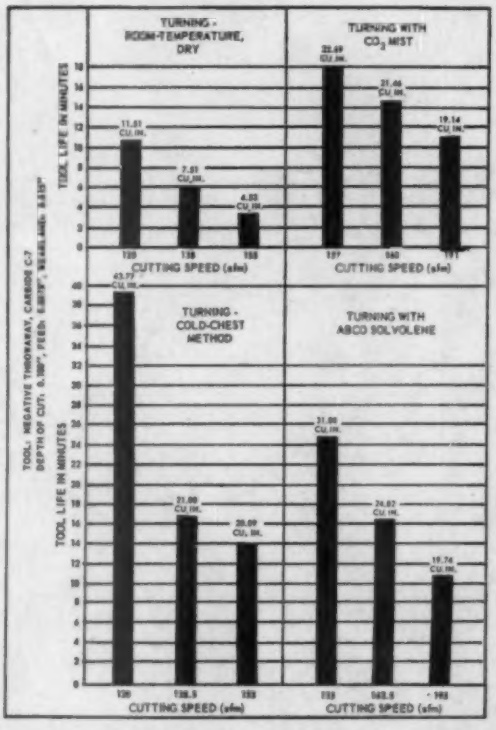
In end milling tests, a spray nozzle directed CO_2 to the cutting edge of the end mill, where the resulting temperature was –63 C (–81.4 F).

Under these conditions, liquid CO_2 expands, depositing a measured amount of solid CO_2 on the tool. As the solid CO_2 absorbs heat, it changes state when it sublimes at one atmosphere. Measurement of

Test results: Turning L-605 (cobalt-base



Effect of sub-zero coolants. At highest turning speeds, CO_2 mist, and flood coolant aided tool life most



Metal removed per tool in turning L-605 at various speeds and with different coolants

liquid CO_2 is critical, as is its chemical purity.

At atmospheric pressure, the temperature of CO_2 is –109 F. It sublimes by absorbing 246 Btu/lb—making it a highly desirable coolant. It is not very toxic, although in an atmosphere containing about 2% CO_2 it will affect the rate of breathing (maximum allowable concentration is about 500 parts per million).

CO_2 has no adverse effect on materials, lubricants or machines, nor does it cause friction or pressure problems.

Sub-zero flooding

Second sub-zero coolant system tested at Convair involved refrigerated ABCO 156 Solvolene, a mixture of 75% Stoddard solvent and 25% trichlorethylene —55 gallons of it in a portable 140-gallon tank.

Temperature of the coolant was lowered to –60 C (–76 F) ± 8 C with 50-lb blocks of dry ice: 400 lb of dry ice were used in an 8-hour shift—300 lb going into the tank at the start, and 100 lb going in after five hours.

In the turning tests, temperature at the 1/2-in.-dia nozzle averaged –50 C (–58 F), reaching a maximum of –40 C.

In face milling tests, temperatures at two 1/2-in.-dia nozzles averaged –60 C. This lower temperature resulted from bypassing the milling-machine sump with a catchpan installed under the vise on the machine table, thus protecting the machine and preventing temperature losses. Cost of CO_2 to refrigerate Solvolene was found to be small in comparison with those for tooling, labor and other costs.

Cold chest method

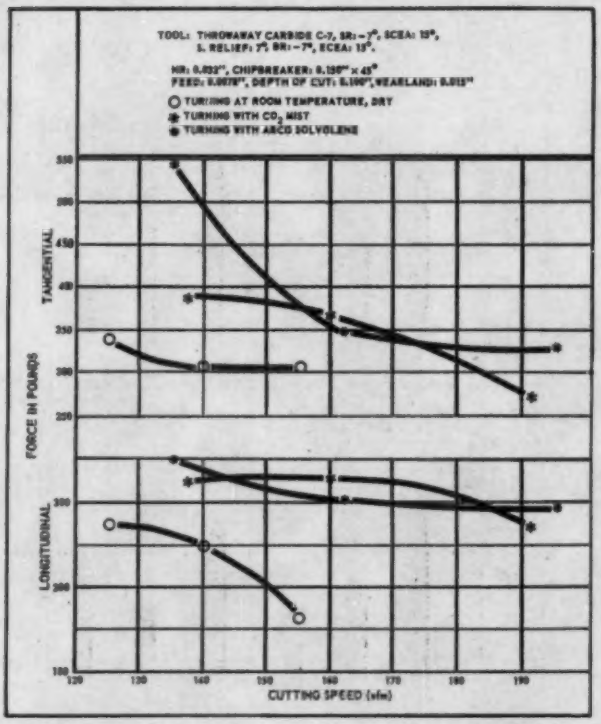
Dry ice and isopropyl alcohol in 50-lb blocks were put into a freezer chest to achieve a temperature of –110 F. Test bars of the various materials were then submerged for 18 hours, removed, brought back to room temperature, and machined.

No attempt was made to machine the bars at sub-zero temperatures, because the bars warmed up very quickly as soon as they were taken out of the chest. For instance, a bar taken from the chest at –110 F reached a surface temperature of –79 F 30 seconds after its removal. In two minutes it reached –53 F, in three minutes –49 F, and in 20 minutes surface temperature of the bar was 0° F.

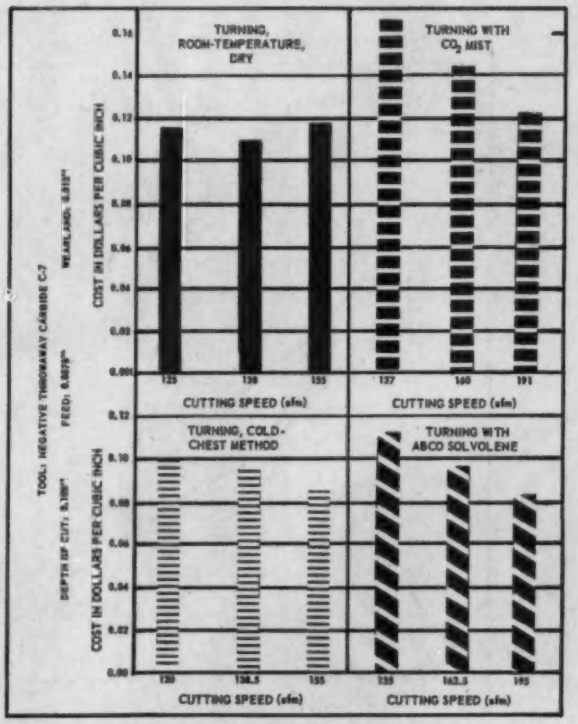
Test procedures

To establish a basis for comparison, Convair first performed machining tests at room temperature with normal cutting fluids or coolants. And to further eliminate variables, only two types were used: (1) Trim, a chemical-solution coolant with good heat-dissipation qualities, with HSS tools, and (2) Sultran

steel) with various coolants and cutting speeds


TOOL: THROWAWAY CARBIDE C-7, SR: –7°, SCEA: 15°,
L. RELIEF: 7°, SR: –7°, ECEA: 15°,
NR: 0.032", CHIPBREAKER: 0.150" x 45°
FEED: 0.0078", DEPTH OF CUT: 0.100", WEARLAND: 0.015"
TURNING AT ROOM TEMPERATURE, DRY
TURNING WITH CO_2 MIST
TURNING WITH ABCO SOLVOLENE
TANGENTIAL
LONGITUDINAL
FORCE IN POUNDS
CUTTING SPEED (sfm)

Tool forces developed in turning L-605 vary only slightly with different coolants and cutting speeds



Comparative metal removal costs per cu in. (one cutting edge) with different coolants and varied cutting speeds

SUB-ZERO MACHINING

B-4, a sulphur-base oil mixed with kerosene in equal amounts, for carbide tools. Sultran helps prevent chips from sticking to tool cutting edges, thus eliminating chipping.

Because the main objective of the Convair tests was to evaluate the practicality of sub-zero machining, economy of operation was the guiding factor in developing test procedures.

For this reason, standard equipment and tooling were used wherever possible. Machine tools, for instance, were standards long used in production at Convair-San Diego. Their condition was satisfactory for conventional production and toolroom work, but preliminary tests showed that ways had to be smoother, spindle bearings and gibs tighter, and backlash had to be eliminated in cross-slides before they could be used in sub-zero machining tests.

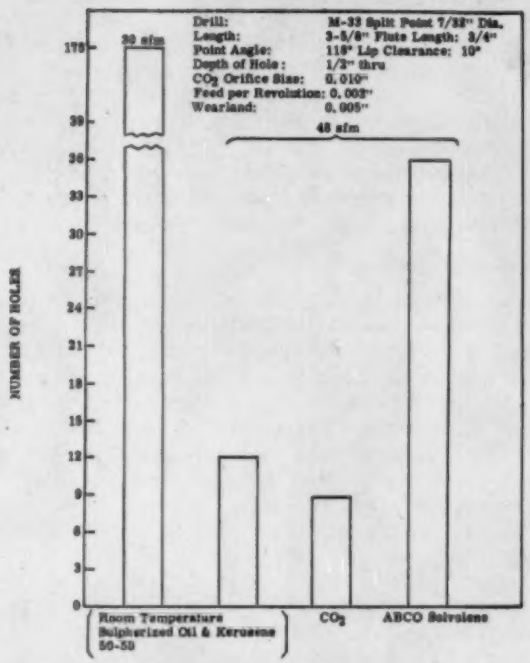
It was clearly established that machines for working the high-strength, heat-resistant test alloys had to be in top condition.

Turning tests were made on a 20-inch Lodge & Shipley engine lathe, mounted on vibration insulators to eliminate shock and vibration from surrounding equipment. A special toolpost holder measured longitudinal and radial forces at the cutting edge of the tools. The holder, operating in conjunction with a dynamometer, was mounted on the cross slide of the lathe in place of a standard tool holder.

Strain gages were attached to a reduced section of

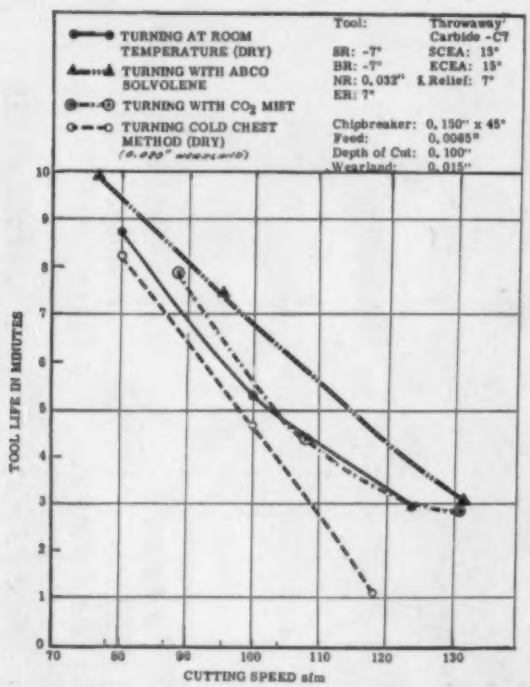
(*Continued on page* 116)

Drilling L-605: flood

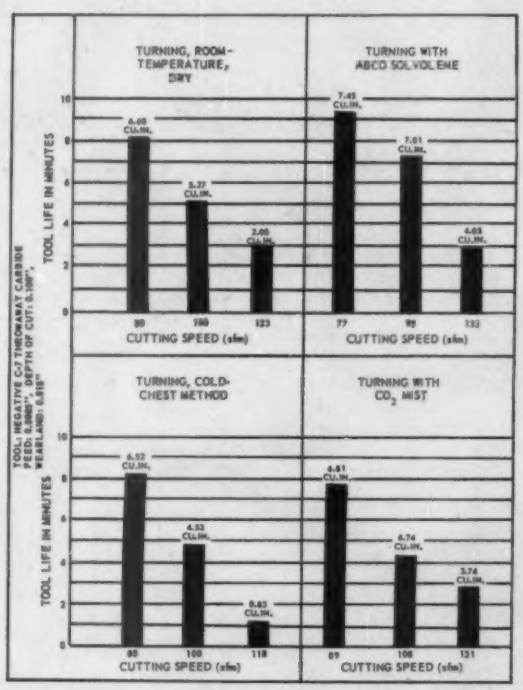


Flood coolant produced best tool life in drilling at 48 sfm. Ordinary coolant achieved good life at 30 sfm

Turning R-235 (nickel-base steel): varying

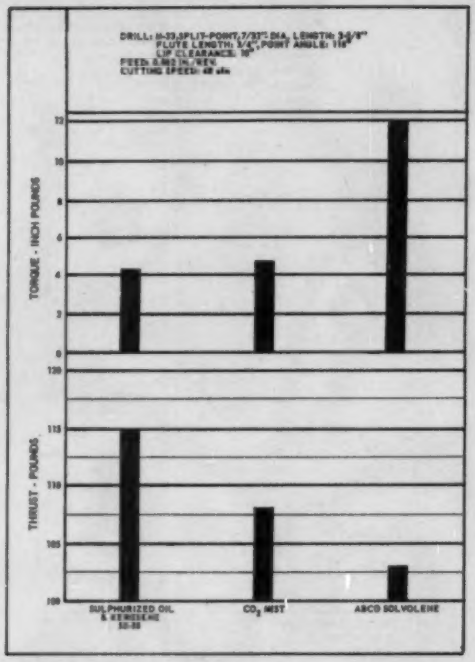


Little difference in tool life was obtained in turning with sub-zero coolants as opposed to room-temperature dry turning

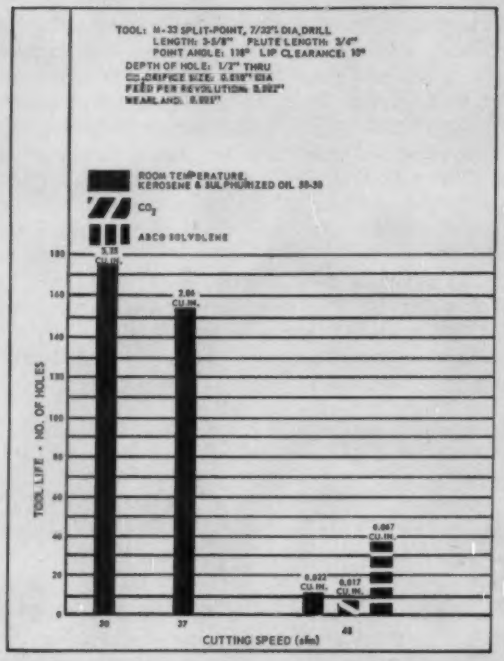


Metal removal rates vary in turning R-235 at different speeds and with different coolants

coolant produces best tool life

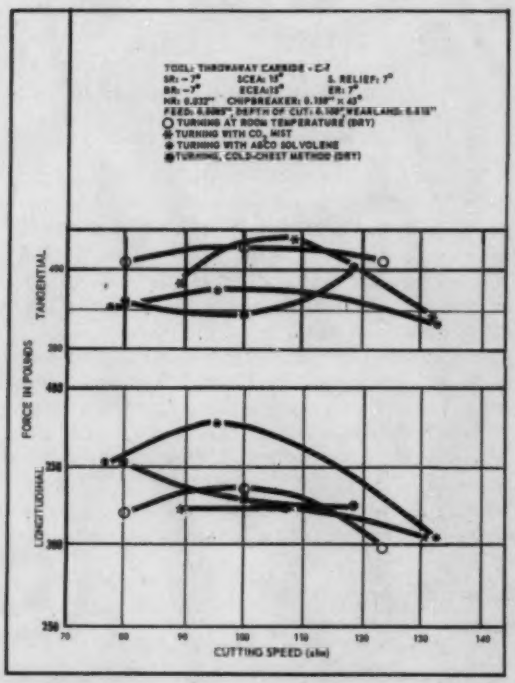


Drilling forces vary with the coolant. Solvolene developed greatest torque, least thrust

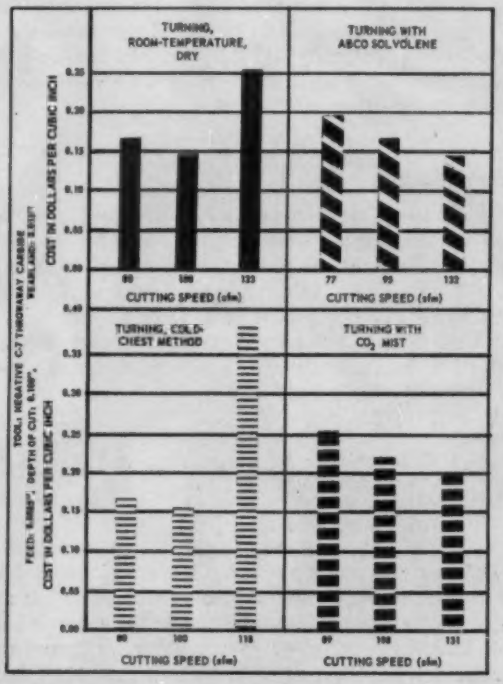


Flood coolant produced best metal removal rate in drilling L-605 at 48 sfm

speeds and coolants affect removal rates



Effect of coolants and cutting speeds on tool forces developed in turning R-235



Cold-chest technique was most expensive way to turn R-235. Cost per cu in. of metal removal at 118 sfm: 38¢

the holder body. Wires leading to the dynamometer (A Sanborn recording unit) were insulated to protect them from damage by hot chips.

In turning, a tool was considered worn out when the wear land reached 0.015 inches. The greatest depth of cut used was 0.100 inches—the maximum for finishing cuts. Feeds were selected to assure a surface finish of 100 micro-inches rms or better. With a chip breaker, these selected feeds produced an easily handled chip. Only tool geometry and grades of carbide were variables. These were established on the basis of tests run at identical speeds and feeds.

Tool materials for turning tests with sub-zero coolants were T5 HSS and Tantung G cast alloy, and C1, C3, C4, and C7 carbides.

Volume of metal removed per tool for all turning operations was based on:

$$V = \frac{D^2\pi}{4} - \frac{d^2\pi}{4} \times L$$

where:

V = volume of metal removed, (cu.in.)
D = dia of bar after the cut, (in.)
d = dia of bar before the cut, (in.)
L = length of cut, (in.)

Face and end milling was done on a No. 5 50-hp Cincinnati vertical dial machine equipped with a backlash eliminator. In face milling, only climb milling was used with standard HSS 6-inch cutters and C1 carbide, Tantung G, and tungsten carbide inserts clamped in throwaway insert bodies. Depth of cut was held to 0.080 in., and wear lands were 0.015 in.

A 1-inch Weldon toolholder was used in end milling. Cutters were considered worn when the wear land reached 0.015 inches. Depth of cut was held to 0.750 inches vertically and 0.080 inches horizontally. Tools were M-2 and T-15 HSS 1-inch-diameter, two-fluted cutters.

Side milling

Side milling was done on a No. 5 50-hp Cincinnati dial horizontal machine with M-2 HSS 12-tooth cutters, 5.75 inches in diameter by 1 inch. In this, as in all other test milling operations at Convair, Kearney & Trecker 1-inch vises were used.

To determine volume of metal removal for test milling operations, Convair used this formula:

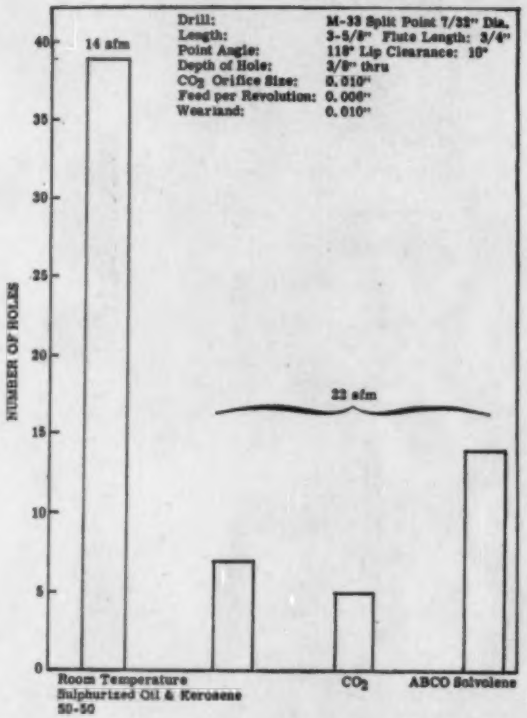
$$V = F \times W \times L$$

where:

V = volume of metal removed, (cu.in.)
F = depth of cut, (in.)
W = width of cut, (in.)
L = length of cut, (in.)

Drilling was performed on a Knight No. 50 7-1/2-hp milling machine, with a table sufficiently big and rigid enough to accommodate a drilling dynamometer and a special platen for measuring thrust and torque forces. Tools (M-33 split-thrust HSS drills 0.219 inches in diameter) were considered worn when wear lands reached 0.010 in.

Drilling R-235: flood



Flood coolant proved most effective in drilling R-235 at 22 sfm

Volume of metal removed in drilling:

$$V = \frac{D^2\pi}{4} \times T \times N$$

where:

V = volume of metal removed, (cu.in.)
D = dia of drill, (in.)
T = thickness of material, (in.)
N = number of holes

Only 1/4-28 HSS taps were used in tapping operations. These were considered worn when a standard Class B thread gage was not accepted in the holes. Percentage of thread depth was 68 to 72%. Work was done on a multiple-spindle Leland-Gifford drilling unit with built-in tapping head.

Power needed to turn and drill all test materials was based on measured forces imposed on the cutting tools. For example, tool forces in turning are those acting in a radial direction, tangent to the rotating work. Longitudinal forces on the tool are those acting in a direction parallel to work axis.

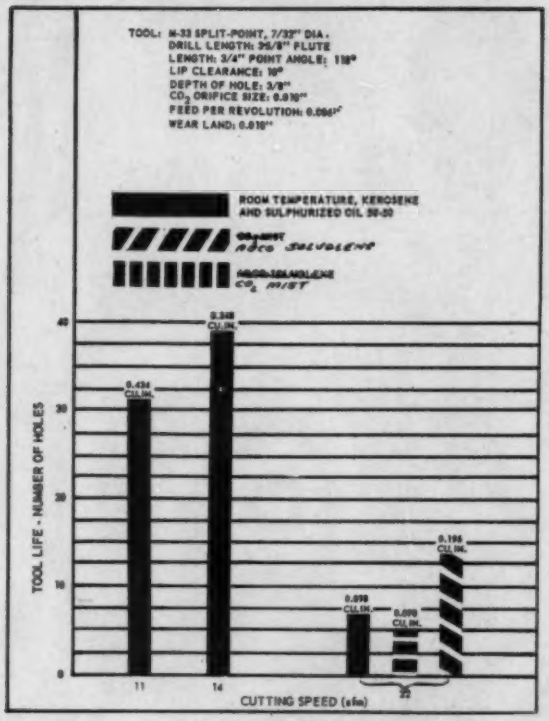
Using the values measured for these forces, unit power requirements for all turning operations were:

$$P_t = \frac{F_t}{396{,}000\ FD}$$

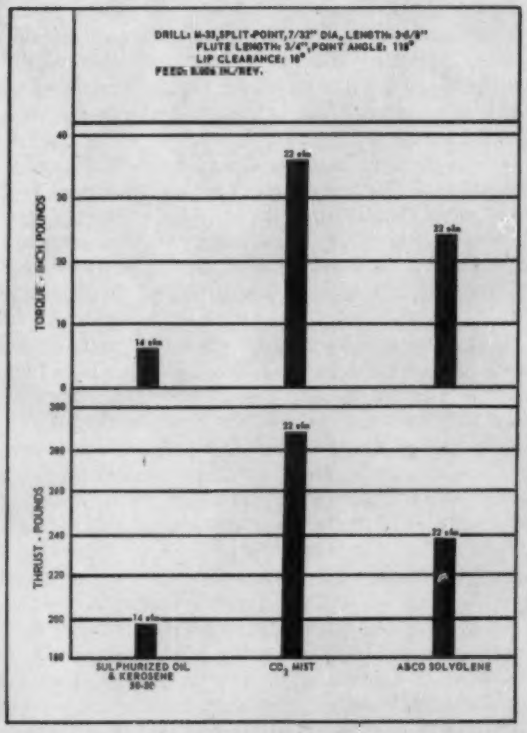
where:

P_t = unit power requirements, (hp per cu. in. per min)
F_t = measured tangential force, (lb.)
F = feed, (ipr)
D = depth of cut, (in.)

coolant is the most effective



Comparative metal removal rates in drilling R-235 at varying speeds and with different coolants



Flood coolant produced lower tool forces than CO_2 mist in drilling R-235. Lowest forces: with room-temperature coolant

Since all turning tools had a 15-deg side cutting edge angle, (SCEA) compensations for F and D were made:

$$F = \text{feed} \times \cos \text{SCEA}$$

$$D = \frac{\text{depth of cut}}{\cos \text{SCEA}}$$

And the tangential force remains the same.

For the coefficient of friction, (μ) in turning:

$$\mu = \frac{F_l + F_t \tan \alpha}{F_t - F_l \tan \alpha}$$

where:

F_l = longitudinal force, (lb)
F_t = tangential force, (lb)
α = resultant rake angle

The tangential force is applied as recorded by the Sanborn unit but the longitudinal force changes with the side cutting edge angle. As a result:

$$F_l = \frac{F_t}{\cos \text{SCEA}}$$

And the resultant rake angle, (α) is determined by:

$\tan \alpha = \tan \text{BR} \cos \text{SCEA} - \tan \text{SR} \sin \text{SCEA}$

where:

α = resultant rake angle
BR = back rake angle
SCEA = side cutting edge angle
SR = side rake angle.

Based on recorded torque and thrust forces, unit power for drilling is:

$$P_d = \frac{50{,}000\ D^2F}{T}$$

where:

P_d = unit power required, (hp per cu. in. per min)
T = torque, (in.-lb)
D = dia of drill, (in)
F = feed, (ipr)

Tests on A-286 steel

Major problem in machining A-286 steel in fully aged condition (31 R_c average hardness) is its tendency to work harden. Sub-zero machining does not lessen this effect, although the relatively high feed rates it achieves do help some.

Wherever wear lands reached as much as 0.010 inches work hardening increased. Generally, it was necessary to maintain constant feeds and to avoid cutter dwell to minimize this problem.

In turning A-286 without coolant in as-received condition (49 R_a), a C6 steel grade of carbide produced better tool life than straight tungsten grades C2 and C4—or the C8 steel grade with positive geometry.

For example, C6 carbide tools lasted 9.3 minutes at 272 sfm, while the next closest at this speed, C2,

produced the 0.015 inch wear land in 6.2 minutes.

A steel grade carbide (C7) with negative geometry was also better than the tungsten grades for turning A-286 in solution-treated and aged condition (49R_c) without coolants. At 210 sfm, this grade lasted more than 13 minutes, compared with 8.5 minutes for C1.

For sub-zero machining, Convair used C7 carbide with negative geometry to achieve a maximum tool life of more than 18 minutes at a speed slightly over 200 sfm with the cold chest method. Metal removed per total was 37.27 cu in. Unit power required was 0.715 hp/cu in./min, and coefficient of friction was 0.83.

At this same speed, 27.69 cu in. of metal were removed per tool in turning A-286 without a coolant. Tool life was about 13 minutes. Unit power required was 0.817 and coefficient of friction was 0.75.

At a higher speed (about 450 sfm), the sub-zero flood coolant produced a tool life of 8 minutes, with metal removal per tool of 27.82 cu in. Unit power required was 0.408 and the coefficient of friction 0.92.

Tool life at 350 sfm with no coolant was only 2 minutes, and only 8.2 cu in. of metal were removed per tool. Amount of unit power needed jumped to 0.715, with a 0.79 coefficient of friction.

No significant increase in tool life was experienced in milling A-286 with sub-zero coolants, as opposed to milling at room temperatures with kerosene and sulphurized oil. Results of drilling and tapping tests were also inconclusive.

Tests on L-605 steel

Excellent results were obtained in turning and drilling L-605 cobalt-base steel with refrigerated ABCO 156 A Solvolene. Generally, however, inconsistencies in the steel's microstructure made it extremely difficult to draw valid conclusions from the machining tests.

Greatest feed rates and most versatility in turning solution-treated L-605 with sub-zero coolants was achieved by a C7 carbide with negative geometry. HSS and cast alloy tools, run at half the speed of the carbide, failed immediately, regardless of coolant used.

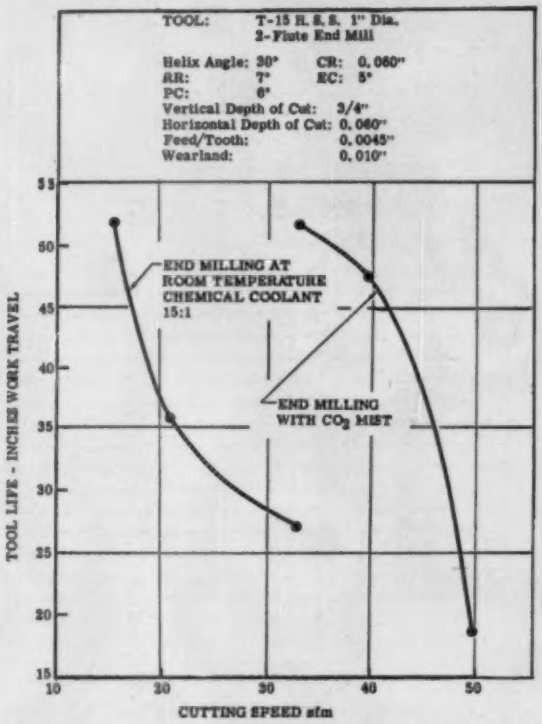
Volume of metal removed per tool differed significantly between machining at room temperature and machining with sub-zero coolant.

At 155 sfm, 0.0078 ipr feed, 0.100 in. depth of cut and no coolant, 4.5 cu in. of metal was removed per tool before the 0.005-in. wear land occurred. Unit power required was 1.000 and the coefficient of friction was 0.44.

Machining with ABCO 156 A Solvolene as a coolant, and with the same feed and depth of cut but with speed increased to 195 sfm, 19.74 cu in. of metal was removed per tool. Tool life was 12 minutes. Unit power required was 1.000 and the coefficient of friction 0.78.

Of various milling tests carried out by Convair, only end milling was effective with sub-zero coolants. A T-15 HSS, 1-in.-dia 2 fluted cutter at 40 sfm, with mist coolant produced a tool life of 125 inches of

End milling R-235 with



CO_2 mist coolant is highly effective in milling R-235 with HSS tools—much better than room-temperature coolant

work travel. By comparison, 95 inches of work travel was obtained with room-temperature chemical coolant. With the conventional coolant, material removed per tool was 4.17 cu in., with CO_2 coolant 5.58 cu in. However, tool life dropped off rapidly as speed increased, even with the sub-zero coolant.

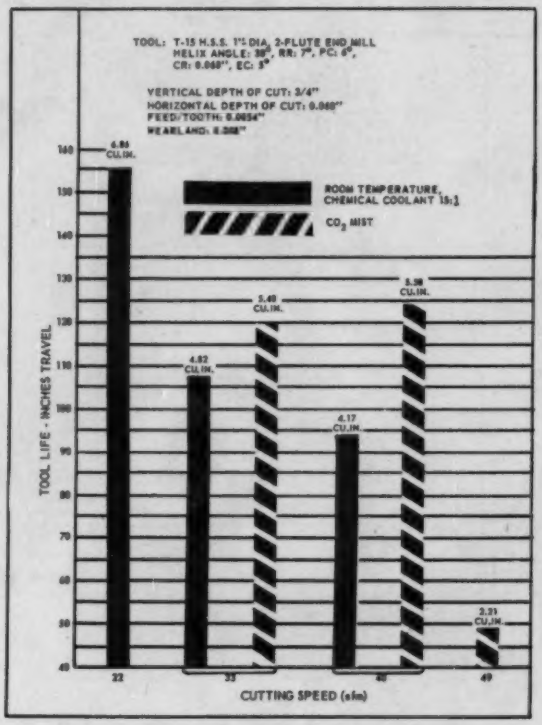
Drilling of solution-treated L-605 (20 R_c) was somewhat simplified by a greater uniformity of structure in plate material than in bar stock. With refrigerated Solvolene as a flood coolant, 36 holes were produced at 48 sfm before wear occurred.

Metal removal rate was 0.067 cu in. per drill with sub-zero coolant, compared with 0.22 cu in. and a life of 12 holes produced with a 50-50 solution of sulphurized oil and kerosene as a room temperature coolant at the same speed.

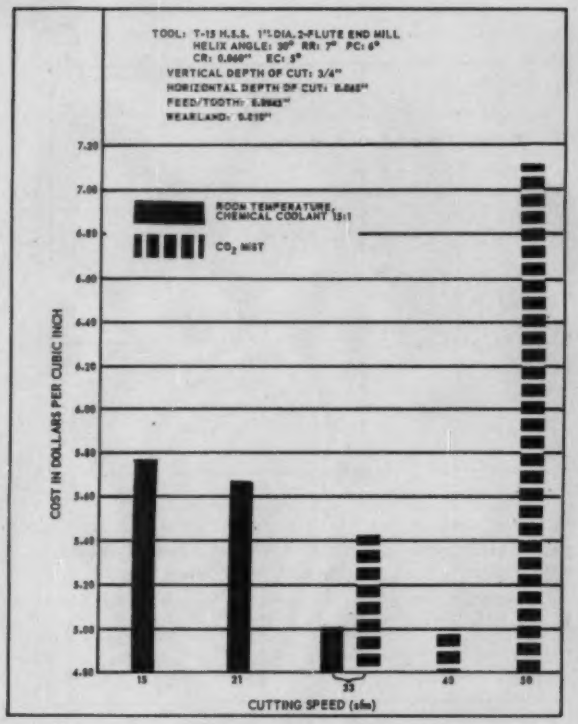
Unit power required with sub-zero flood coolant was 2.51, compared to 0.90 for conventional coolant. CO_2 mist under the same conditions produced only 9 holes at a metal removal rate of 0.022 cu in. At a lower speed (30 sfm) room temperature coolant gave drills a life of 175 holes, and 3.25 cu in. metal removal.

Room temperature tapping of L-605 proved better than tapping with any of the sub-zero techniques. At 10 sfm, Tapit compound diluted with Johnson's wax oil produced 94 holes before a 2-flute spiral-point gun tap wore out, whereas only 37 holes were

HSS tools: CO_2 mist is effective



Best metal removal rates per tool were achieved with CO_2 mist in end milling at various speeds



At 40 sfm, CO_2 mist was the least costly coolant applied in end milling. Metal removal per cu in. is compared here

tapped with the same kind of tap with CO_2 mist at the same speed. This sub-zero coolant, incidentally, produced only 6 holes when speed was increased to 20 sfm.

Testing R-235

As with L-605, inconsistencies of grain size and structure in R-235 bars made it difficult to obtain uniform results with various machining operations. And this material showed the least response to sub-zero techniques when carbide tools were used. Turning tests with HSS and cast alloy tools were conducted with sub-zero coolants within a speed range of 23 to 70 sfm. Regardless of the coolant used, tools broke down immediately at speeds over 30 sfm.

Carbide tools, negative geometry

To approach more effective speeds without a coolant, grade C7 inserted carbide tools with standard negative geometry were used to turn solution treated and aged R-235 with a resulting life of 5.27 minutes at 100 sfm. At maximum turning speed, (130 sfm) sub-zero flood coolant produced a tool life of 3 minutes, as did CO_2 mist. But this same life was achieved with no coolant at only slightly lower speed: 123 sfm. This provided a metal removal rate of 2.05 cu in., a unit power requirement of 1.225 and a coefficient of friction of 0.63.

At 130 sfm, metal removal per tool with ABCO 156A Solvolene was 4.0 cu in., unit power required was 0.817, and the coefficient of friction, 0.79. With the CO_2 mist coolant at this speed, metal removal rate was 3.74 cu in., unit power required was 1.021 and the coefficient of friction 0.77.

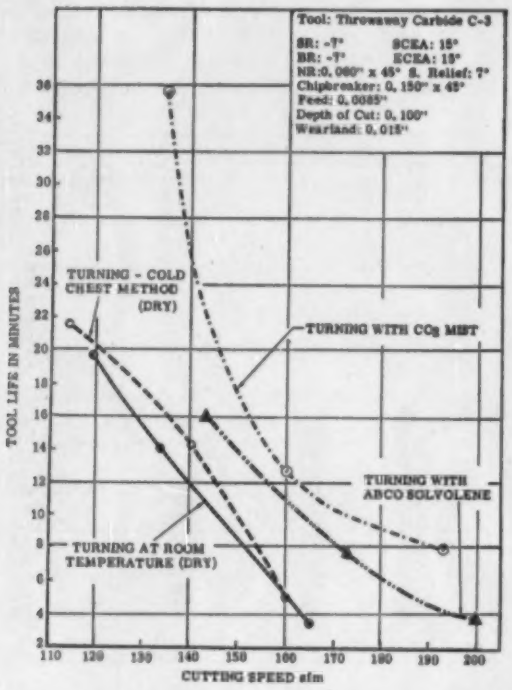
Standard 6-in.-dia cutters with neutral radial and axial rake angles and a 5-degree lead angle were used with C1 carbide inserts for face milling R-235. No practical improvement in tool life resulted with sub-zero flood coolants as compared with that of room temperature kerosene and oil. Wear on all milling inserts was similar to that of turning tools. (A groove developed at the extreme depth of cut and could not be prevented by stoning the cutting edge.) Chipping of cutting edges, which occurred at the beginning of a cut and at breakthrough, (at the end of a bar) was partially controlled by stoning a narrow land on the cutting edge. A feed rate of 0.0075 ipt helped prevent chips sticking to the cutting edge.

End-milling R-235

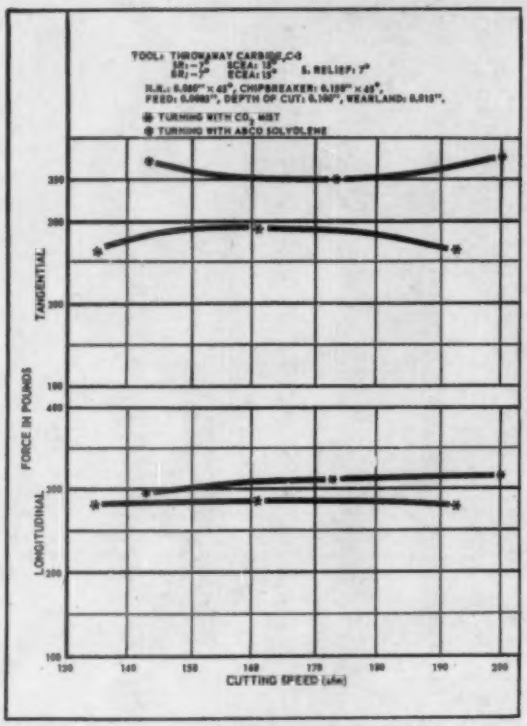
In end milling this material, good tool life was obtained with a T-15 HSS, 1-in.-dia, 2-flute tool, using CO_2 mist as a coolant. At 33 sfm, tool life was about 52 inches of work travel, compared with 26 inches for room-temperature chemical coolant.

SUB-ZERO MACHINING

CO_2 mist coolant proves best for turning H-11


Tool: Throwaway Carbide C-3
SR: -7° SCEA: 15°
BR: -7° ECEA: 15°
NR:0. 060" x 45° S. Relief: 7°
Chipbreaker: 0. 150" x 45°
Feed: 0. 0085"
Depth of Cut: 0. 100"
Wearland: 0. 015"
TURNING - COLD CHEST METHOD (DRY)
TURNING WITH CO_2 MIST
TURNING WITH ABCO SOLVOLENE
TURNING AT ROOM TEMPERATURE (DRY)
TOOL LIFE IN MINUTES
CUTTING SPEED sfm

CO_2 mist coolant effectively removes heat from the chip before it passes over the tool face—prolonging life



Cutting forces in turning H-11 with Co_2 mist and with refrigerated Solvolene are fairly close

Metal removal rate with CO_2 mist was 2.34 cu in., with chemical coolant only 1.21 cu in.

Drilling R-235 with sub-zero flood coolant also produced excellent results. It was found that the hard, heat-resistant cobalt-alloy M-33 tools worked best, and that exact duplication of drill point geometry was essential for repeatable results. Even the slightest variation in lip clearance angles, point angles, and splitting of the chisel edge greatly affected the number of holes produced.

A fairly heavy feed of 0.006 ipr produced the best results, probably because the heat generated helped shear chips from the parent metal. An increase over this feed rate rapidly burned drills at the intersection of the margin and lip. At highest speed (22 sfm), and with refrigerated ABCO 156A Solvolene as a coolant, a unit power of 1.67 was required. About 14 holes were made before wear occurred. Metal removed per tool was 0.136 cu in.

CO_2 mist demonstrated the poorest results: 5 holes and only 0.030 cu in. of metal removed per tool. Unit power requirement was 2.51. Room temperature sulphurized oil and kerosene produced 7 holes with a metal removal rate of 0.038 cu in. At a somewhat lower speed, however, (14 sfm) room temperature coolant produced 38 holes before a drill wore out and 0.548 cu in. of metal per tool was removed. Unit power required was 0.63 hp/cu in./min. Sub-zero tapping this material produced no significant results.

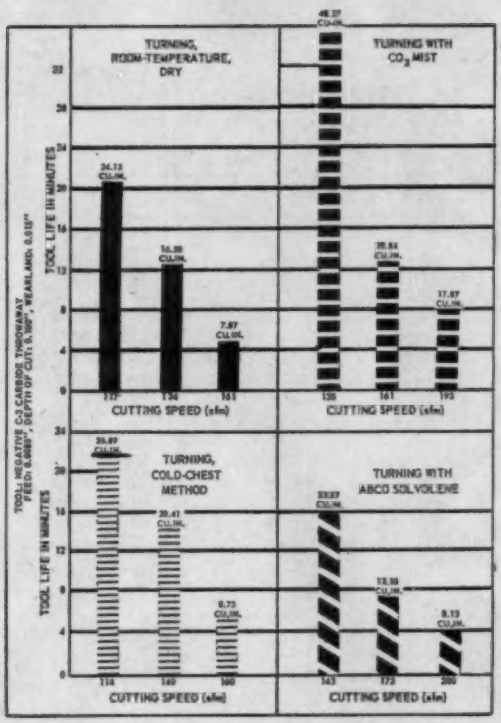
Testing H-11 steel

All test bars of H-11 were heat treated to maximum strength before machining and, to facilitate these operations through a uniform structure, the bars were given a triple temper. The resulting hardness ($51R_c$) was too great for machining with HSS tools at the speeds selected for sub-zero coolant evaluation, so only carbide tools were used.

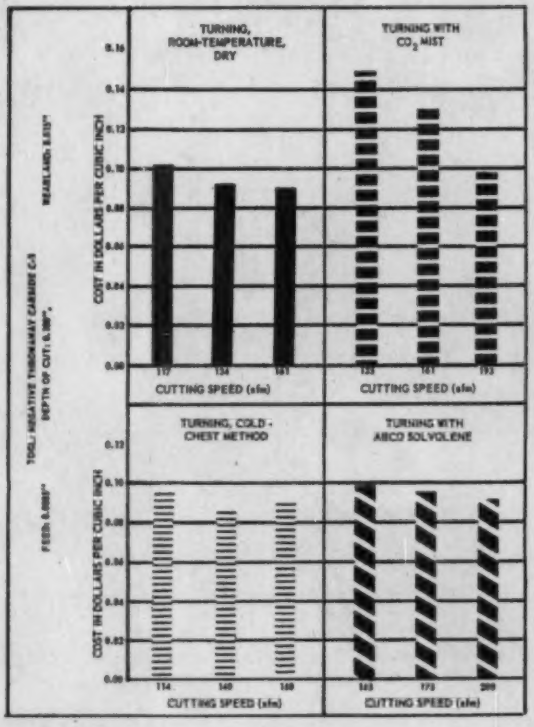
In turning H-11 with C-3 grade carbide tools and CO_2 mist coolant, heat was effectively removed from the chip before it passed over the tool face. Metal removal rate was 48.27 cu in., and tool life was about 36 minutes at 135 sfm. Unit power required was 0.715, with a coefficient of friction of 0.93. These factors were 0.613 and 0.93, respectively, when the speed was increased to 193 sfm. Metal removal dropped to 17.87 cu in. and tool life to 8 minutes. With no coolant, however, only 24.13 cu in. of metal removal per tool and a 19 minute tool life were obtained at barely 117 sfm.

ABCO 156A Solvolene was applied on top of the tool. This allowed only a small amount of coolant to reach the chip-tool interface and the

(hot-work die steel)



CO_2 mist achieved highest metal removal rate in turning at 135 sfm—48.27 cu in.



Comparative cost of metal removal per cu in. with one cutting edge, and with various speeds and coolants

frictional area. Consequently, results obtained with the refrigerated flood coolant were not as good as those obtained with CO_2 mist. But they were considerably better than the results obtained with room-temperature machining when no coolant was used.

Bars refrigerated by the cold chest method produced only slightly better tool life than that obtained without coolants. Actually, little effect was produced on the machinability of H-11 by freezing the work for 8 hours at –110 C (–166 F). Results of milling, drilling, and tapping tests on H-11 were not conclusive.

Testing Moly-Ti

Of all the materials tested, Mo-0.5% Ti was the most consistent with regard to structure and uniformity of machinability. In turning tests, carbide tools with CO_2 mist as coolant resulted in much improved tool life. At 400 sfm, for example, tool life was 18 minutes, compared with 5½ minutes when turning with no coolant. Metal removed per tool at this speed with CO_2 mist was 66.25 cu in. Unit power required was 1.000, with a coefficient of friction of 0.65.

Tantung G and T-5 HSS tools were used, too, with the latter showing up particularly well when CO_2 mist was applied. At 149 sfm, HSS tool life with CO_2 mist was 8 minutes, and 11.19 cu in. of metal were removed per tool. About the same power was required when no coolant was applied, but tool life was only 4 minutes and the metal removal rate dropped to 5.27 cu in.

Milling results inconclusive

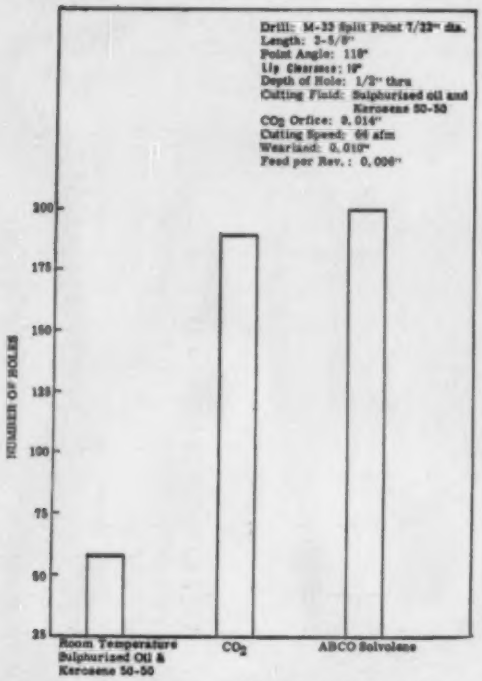
Although results in milling this material were inconclusive, drilling with CO_2 mist and refrigerated flood coolant provided much greater tool life than was obtained with 50-50 sulphurized oil and kerosene coolant. M-33 drills, running at 66 sfm and a feed of 0.006 ipr with ABCO 156 A Solvolene, produced 200 holes before wear occurred (about 185 were produced with CO_2). The same drills with conventional coolant had a life of only 55 holes.

Metal removal rate with flood coolant at 66 sfm was 3.72 cu in. With CO_2 mist at the same speed it was 3.51 cu in., and with room temperature coolant, 1.04 cu in. Unit power required for drilling Mo-0.5% Ti with sub-zero flood coolant at 66 sfm was 1.46, with CO_2 mist 2.16, and with conventional coolant 0.36.

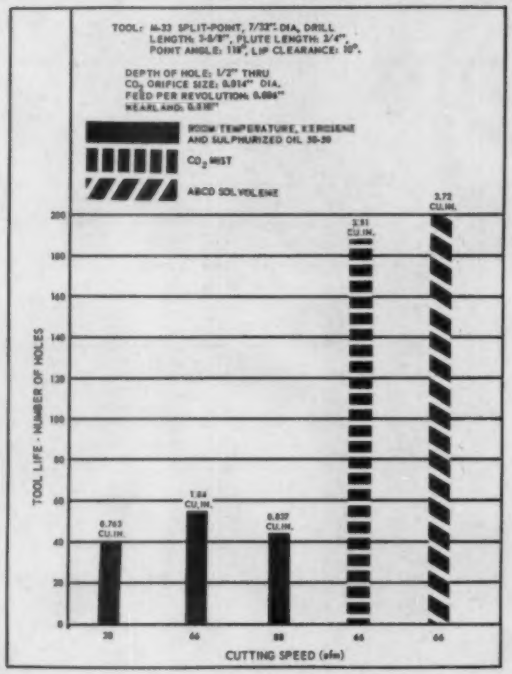
Tapping this material with sub-zero coolants did not produce substantial improvements over conventional techniques.

SUB-ZERO MACHINING

Drilling Moly-Ti alloy: sub-zero flood

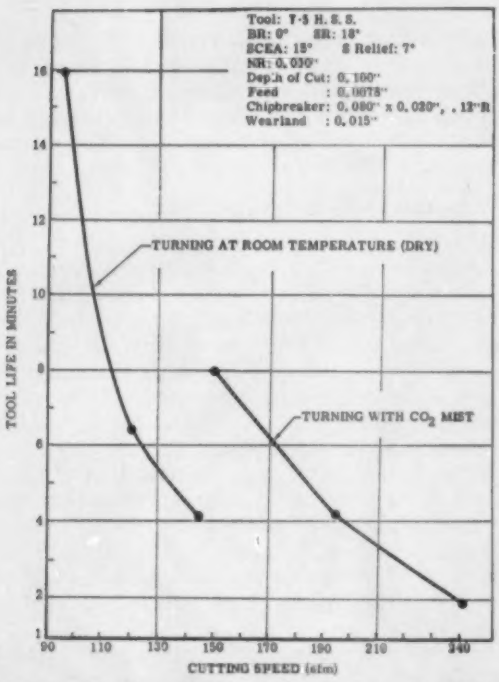


Flood coolant and CO_2 mist produced significantly better tool life than room-temperature coolant in drilling at 66 sfm

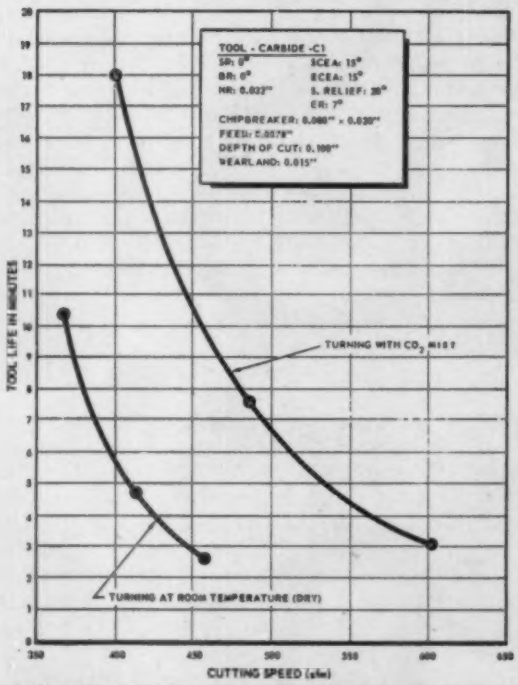


Mist and flood cooling produced far better metal removal per tool and tool life than did conventional coolants

Turning Moly-Ti alloy: CO_2 mist triples

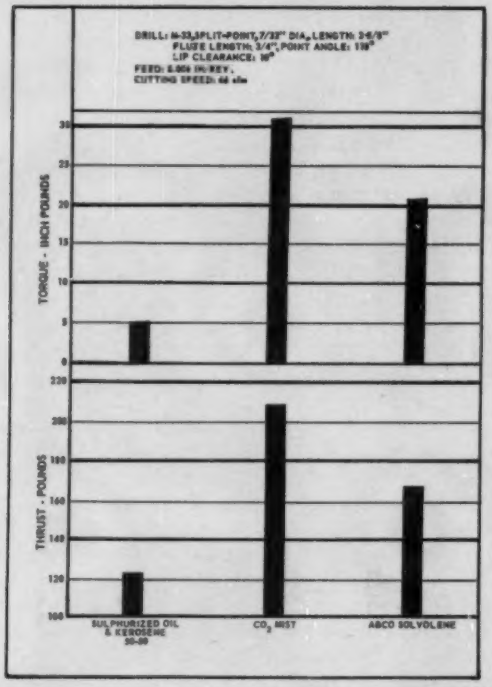


HSS tools and mist coolant were effective in turning Ti-Moly at relatively high speeds

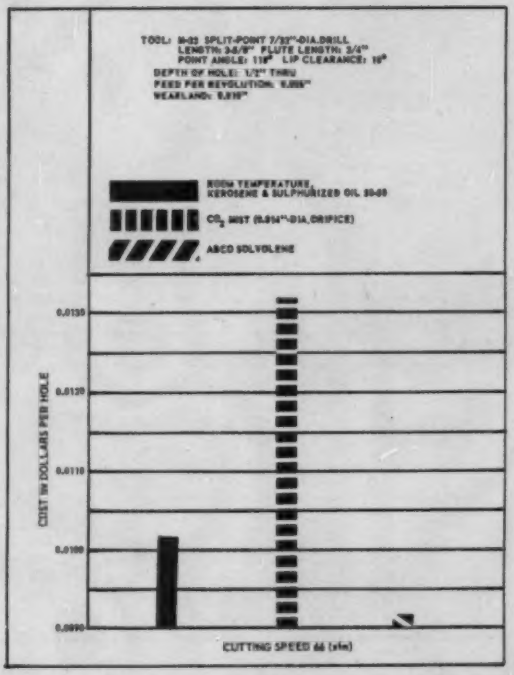


Carbide tools and CO_2 mist produced best results in turning at 400 sfm—200% better tool life than with no coolant

coolants and CO_2 mist prolong tool life

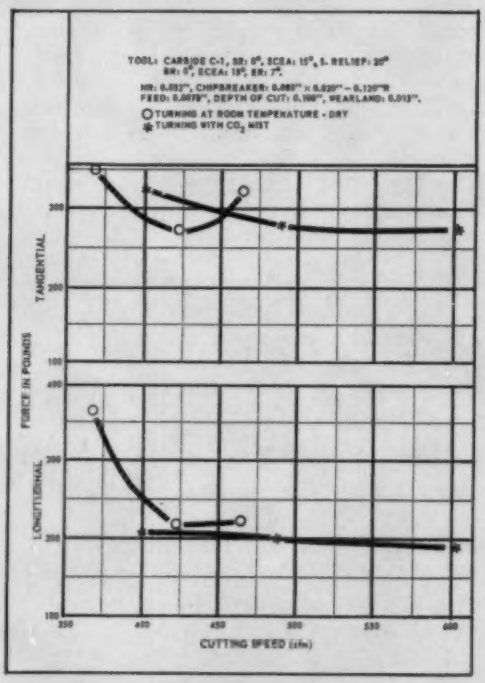


Comparative effect of coolants on tool forces in drilling Ti-Moly at 66 sfm

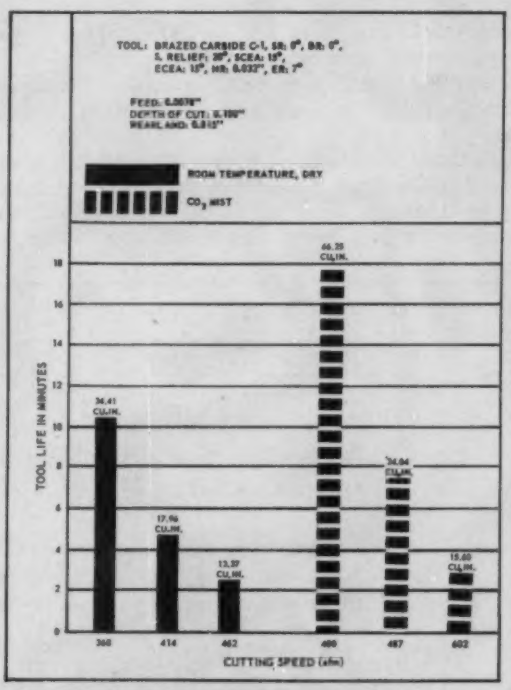


Lowest cost per hole in drilling at 66 sfm was achieved with sub-zero flood coolant

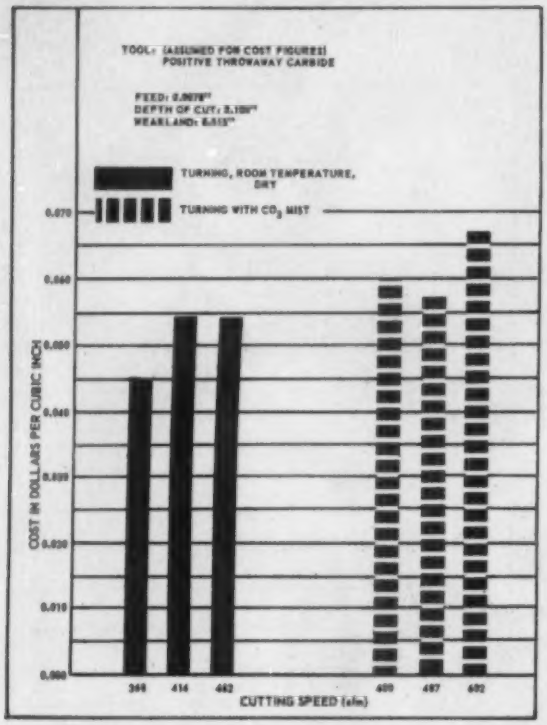
tool life at high speeds



Cutting tool forces produced with carbide tools and CO_2 mist are lower than forces developed under ordinary conditions



Turning with CO_2 mist and carbide tools at 400 sfm resulted in a metal removal rate of 66.25 cu in.



Comparative cost of metal removal per cu in. (one cutting edge) in turning Ti-Moly with different speeds, coolants

What next?

While the Convair-Air Materiel Command sub-zero machining tests are by far the most comprehensive ever undertaken, they are by no means definitive. But they do serve as signposts pointing out what must be done to improve the state of the art.

For instance, much more research is needed in such areas as condition of machines, materials and cutting tools. It would, for example, be helpful to establish minimum requirements for spindle-bearing tightness on lathes, milling machines, and drilling equipment for machining high-strength, heat-resistant alloys.

It would help, too, to look into machines with infinitely variable spindle speeds and feeds.

As to the alloys themselves, a complete analysis and evaluation of mill practices in their manufacture would determine whether machinability of these metals could be improved at that stage.

Ideally, these alloys should have completely homogeneous structures, should be free from local segregation of carbides or other hard particles, and should be uniform from bar to bar and lot to lot. One thing: Free machining additives might improve machinability without adverse effect on mechanical properties.

It would be advantageous, too, to investigate the maximum geometry tolerances for reconditioning cutting tools to machine super steels.

And what about checking to see if there are existing automatic cutter grinders that can assure uniform results in regrinding rake and clearance angles, nose radii, and other elements of geometry affecting tool performance? If not, the time is *now* to begin R & D of such machines—for hard-to-machine alloys are here to stay. What may today seem a wildly exotic blue-sky machining problem applicable only to the aircraft and missile industry and to highly specialized shops, will be common metalworking practice tomorrow.

In line with continuing research into sub-zero machining, Convair has already been given the green light for Phase III of its program (This report is on the results of Phase II).

Taking the findings of Phase II as a launching pad, Phase III will research production of parts made from high-strength, heat-resistant materials. The successes of Phase II will provide the basis for this research.

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- Drilling L-605 with ABCO 156 A Solvolene.
- Turning L-605 with ABCO 156 A Solvolene.
- Turning H-11 with CO_2 mist.
- Turning A-286 with ABCO 156 A Solvolene.
- Drilling R-235 with ABCO 156 A Solvolene.
- End milling with CO_2 mist.

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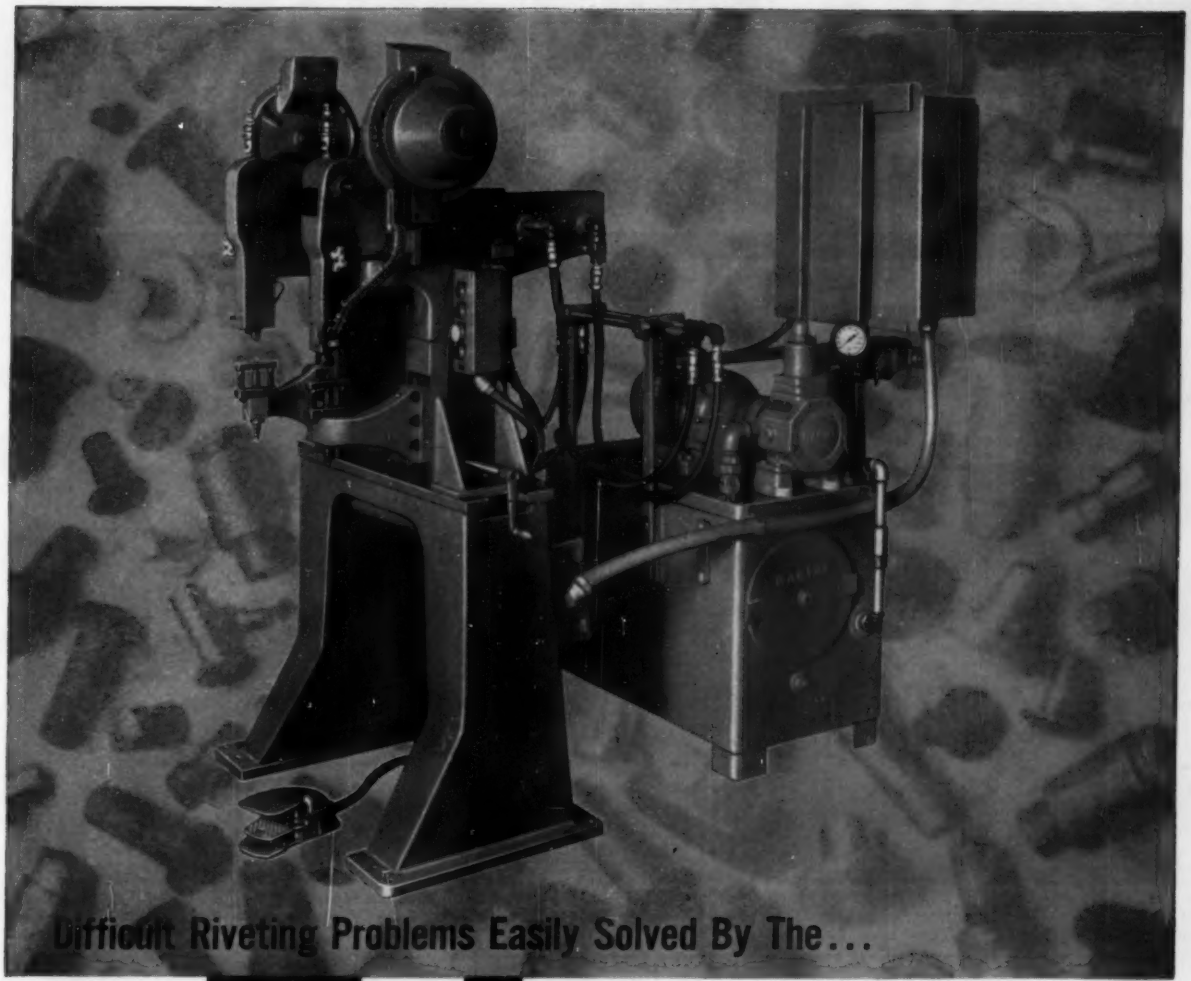

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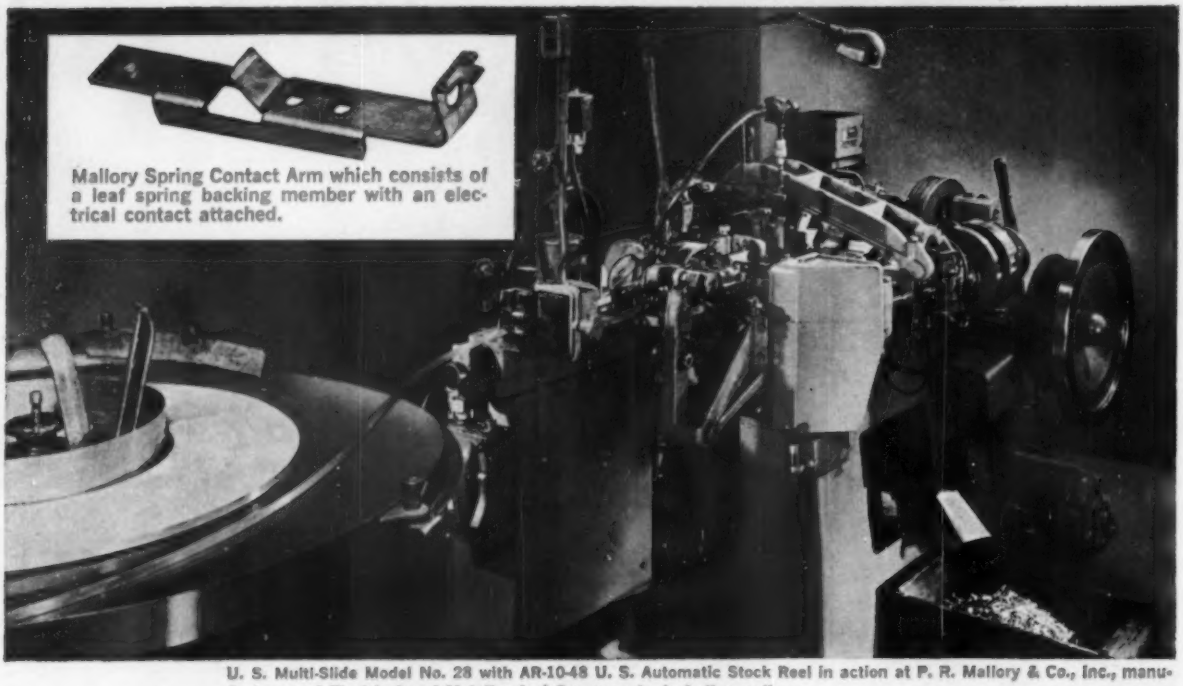

U. S. Multi-Slide Model No. 28 with AR-10-48 U. S. Automatic Stock Reel in action at P. R. Mallory & Co., Inc., manufacturers of Electrical and Metallurgical Components, in Indianapolis.

By the use of a U. S. Multi-Slide Model No. 28, P. R. Mallory and Co., Inc. — specialists in complete contact service — entirely eliminated one costly operation in the fabrication and assembly of Spring Contact Arms.

Today, these Contact Arms are formed and assembled on a U. S. Multi-Slide. Coil stock for the Contact Arms is fed from a Model AR-10-48 U. S. Automatic Stock Reel. This Multi-Slide pierces, trims, forms and cuts off the spring arms and attaches the prefabricated, hopper fed contacts in one continuous, automatic operation.

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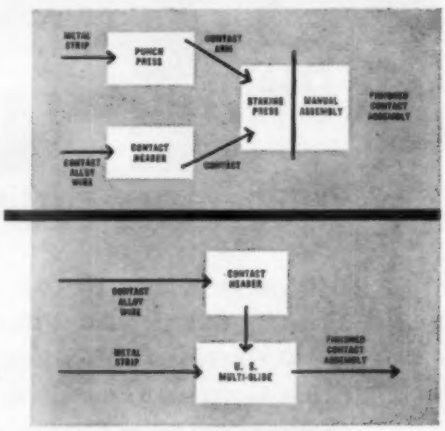

This shows how a U. S. Multi-Slide eliminated a separate staking press operation. This operation (now eliminated) required manual loading which was slow and costly.

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Snap-Action Switches in Dies—III

By P C Starr, manager, Manufacturing Engrg, Meter Dept, Westinghouse Electric Corp, Raleigh, NC

Snap-action switches, arranged to detect misfeeds and other faulty conditions, reduce die maintenance and provide for safe operation. These benefits can be obtained at a cost of less than $200 for equipping a press.

Parts I and II on snap-action switches showed typical applications to dies (*AM/MM*—May 2 '60, p129). Those pages were written by George O Brown, supervisor, Tool Design & Procurement, Micro Switch Div, Minneapolis-Honeywell Regulator Co. The independent treatment that follows discusses shop experience with such switches at Westinghouse Electric Corp's Meter Dept, Raleigh, N C.

Faults Detected

The seven most common faults (see table) which can normally be detected by switches fall into three categories:

A. Faults which do not immediately result in a miscut,

B. Faults which are detected at the bottom of the ram's stroke and result in one miscut, and

C. Faults detected during the down stroke of the ram, where immediate braking may prevent any damage.

For the first two groups, any type of clutch-brake is satisfactory, including the positive type, which will stop the press only at the top of the next stroke. For the third group, an electric or pneumatic type of clutch would be required for immediate braking.

To compare safety performance of switches against full-time operators, see Figs. 1, 2 and 3. In each case the heavy modified sine wave represents vertical displacement of the press ram with respect to time. In all examples, the press is assumed to be operating at 120 strokes per minute. If an operator will react to a fault in ¾ sec, two or even three miscuts will be made

Seven Types of Faults Detected by Switches

Group	Result of Fault	Type of Fault	Type of Clutch-Brake
A	No immediate miscut	1. Dereeler not paying out 2. Stock out 3. Parts chute full	Any — immediate braking not required
B	One miscut	4. Pulled blank or slug 5. Misfeed detected by pilot pin retracting	Any — fault detected as first miscut is made
C	Miscut may be prevented	6. Misfeed detected by stock buckling 7. Misfeed detected by failure to register of repeating feature of stock or scrap	Pneumatic or electric — immediate braking may prevent or reduce damage

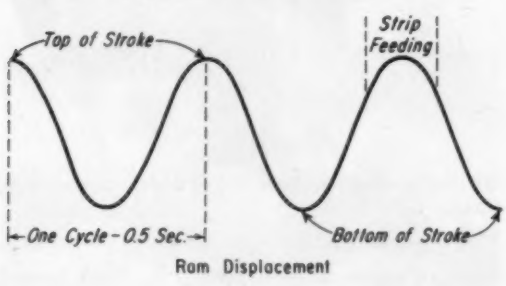

Fig. 1—Group *A* faults: Operator's reaction time of ¾ sec (shaded area) is sufficient to stop press before a miscut

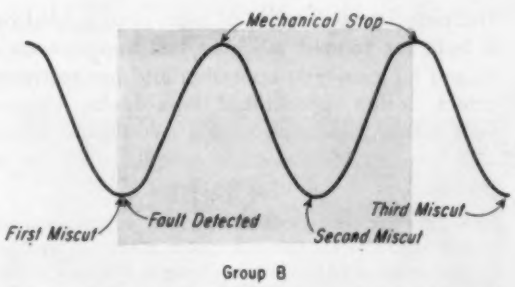

Fig. 2—Group *B* faults: Operator cannot avoid two miscuts anyway, and a mechanical clutch will allow a third miscut

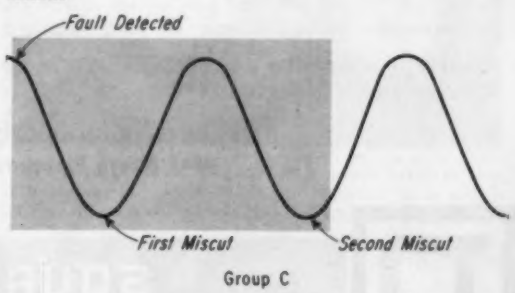

Fig. 3—Group *C* faults: Operator can't avoid two miscuts; a safety switch plus pneumatic clutch-brake might avoid the first miscut

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Snap-Action Switches in Dies—IV

in many cases before the operator can stop the press. (Often it is the second rather than the first miscut which really damages the die.) By contrast, use of switches will avoid most miscuts and under the worst conditions permit only one miscut.

Fig. 1 shows vertical displacement of the ram against time. For a press running at 120 strokes per minute, the cycle time is ½ sec. The total time represented here is 2½ cycles or 1¼ sec. Note that strip feeding takes place during the last half of the upstroke and the first half of the next down stroke.

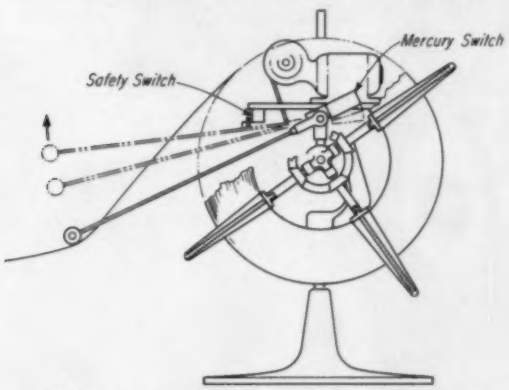
For the faults in Group *A*, there is no immediate danger of a miscut, and an operator can normally stop the press before damage occurs. A safety switch will certainly stop the press with ample time to spare.

Assuming that the fault was detected at the point shown and the first miscut would occur on the stroke shown, the operator has more than ¾ sec. reaction time (shaded area) in which to stop the press.

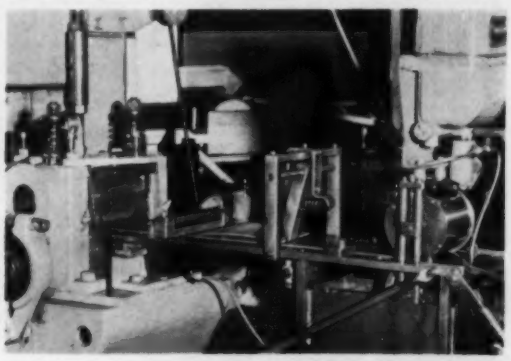
The point marked "Mechanical

Specific Examples

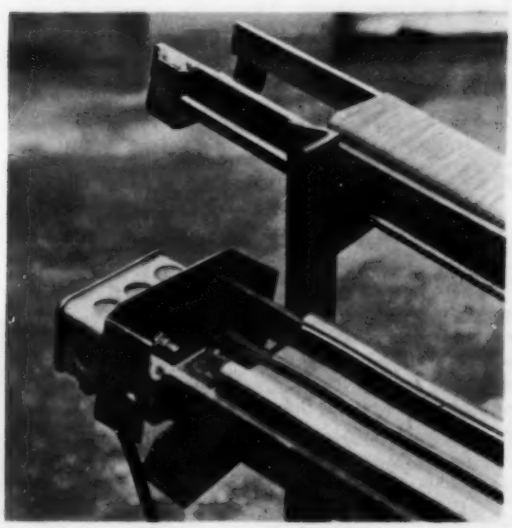
Six typical switch applications are illustrated below. Although there are many other situations where switches can be used, these six applications protect the press from the faults most commonly found. Pilot-pin protection was shown earlier (*AM/MM*—May 2 '60, p 129.)



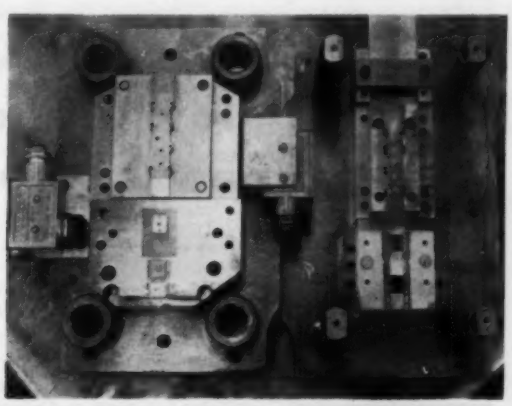
1. Dereeler Fails to Payout Enough Material—The lever arm that rides on stock raises as slack is taken up, actuating the dereeler motor. If the motor fails to operate, the lever arm continues to rise until it strikes a safety switch, which is connected to stop the press at the top of the next stroke.



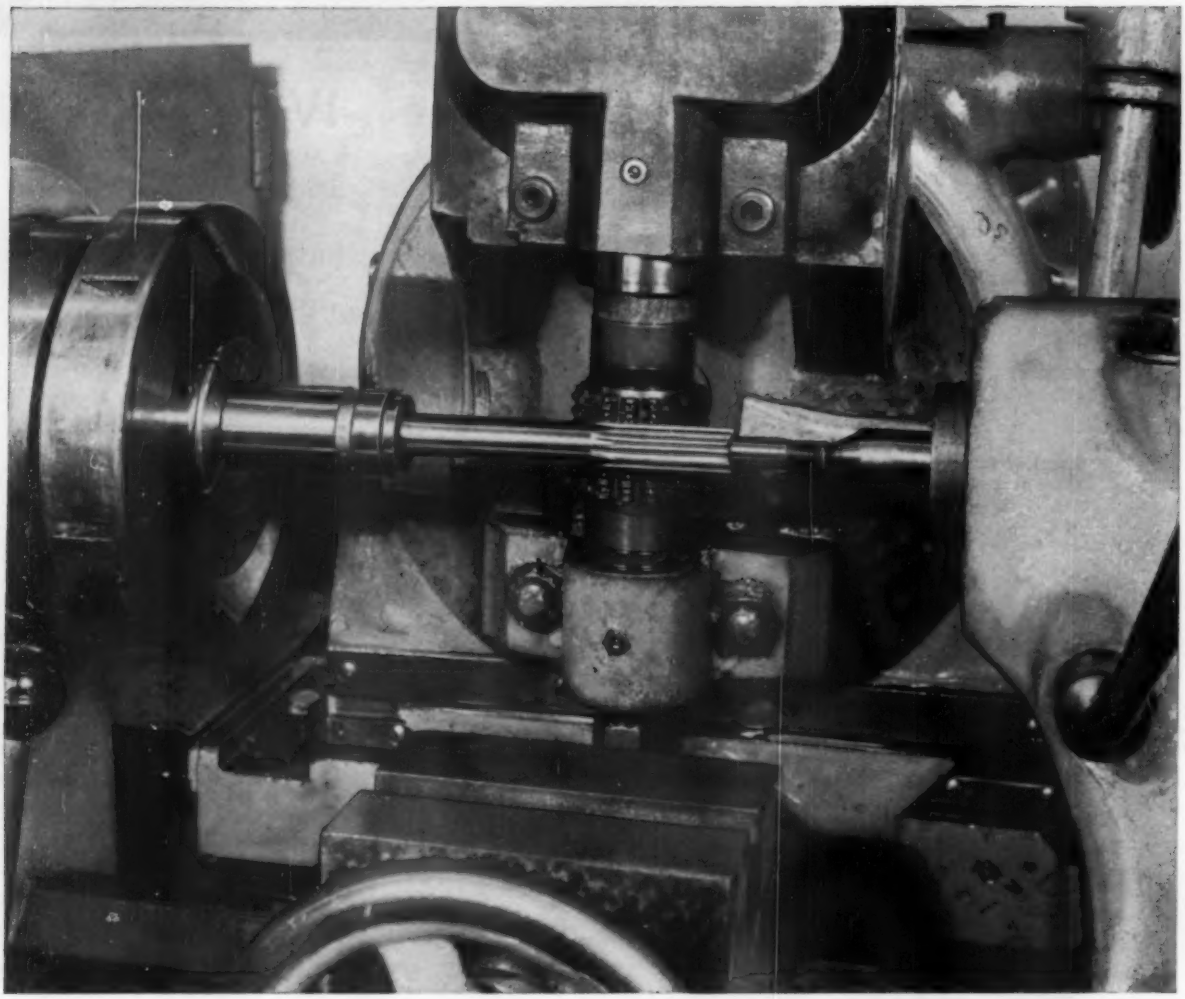
2. Stock Out—A spring-operated lever rides over stock at an angle. When the stock is exhausted, the spring pulls the lever back to a vertical position, striking a safety switch which stops the ram at the top of the next stroke.



3. Parts Chute Full—As a punched part is pushed down a full chute, a safety switch located at the end of the chute will be actuated to stop the press at the top of the next stroke.



4. Pulled Blank or Slug—When a pulled blank or slug is riding on the stock, it can be detected by a switch which will pick up the resulting overtravel of a pressure pad. Because the first miscut will have already occurred, the switch can be connected to stop the ram at the top of the next stroke.



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Snap-Action Switches in Dies—V

Stop" indicates the last point at which the ram can be stopped by a positive clutch-brake before a miscut would be made.

Because there is no immediate danger of a miscut, the controls for this type of fault-detection would be set to stop the ram at the top of its stroke, regardless of the type of braking available.

For the faults in Group *B*, which are not detected until the first miscut has been made, the objective is to prevent a second miscut and further damage to the die or to the press.

Action of a snap-action switch is such that there is ¼ sec., or ample time, for the switch to trip a clutch-brake. Because there is no advantage to immediate braking, the switch is connected to stop the press at the top of the next stroke, regardless of the clutch-brake type available. If an operator controls the press, it is obvious that a second miscut will occur. As shown, a third miscut will also occur if the press is equipped with a positive type of clutch, because the reaction time is long enough to go beyond the top of the stroke preceding the third miscut. With the other types of clutch-brakes the operator will avoid the third miscut.

For the faults in Group *C*, which are detected during or at the end of the strip feeding motion, there is very little time in which to avoid the first miscut.

As was the case with Group *B* above, the operator's reaction time could not prevent either of the first two miscuts from occurring.

Although the time interval is very short between the fault detection and the point at which the electric or pneumatic clutch must stop the ram, the first miscut may be avoided by a snap-action switch. This depends on the point at which the fault is detected, the efficiency of the brake, and the inertia of the ram. In any event, the snap-action switch will slow the ram, tending to reduce any damage on the first miscut. And there will certainly be no second miscut.

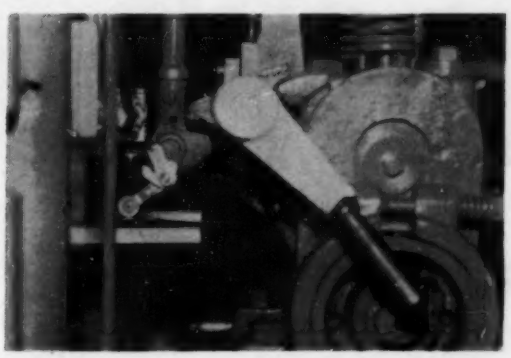
Personnel Safety

An important advantage of equipping presses with snap-action switches is the reduced danger of operator injury. Particularly with the slower-running presses, there is a tendency on the part of some operators to try to clear a jam or remove a pulled slug while the press is running. If the operator is aware of the fact that the press is protected by switches, he will tend to rely on them instead of risking the loss of a hand.

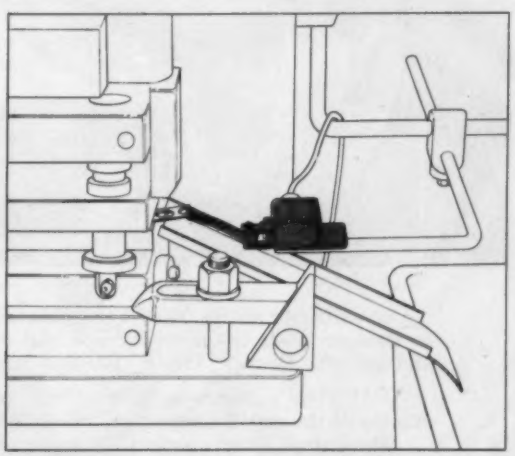
Switch Life

The switches discussed are of the snap-action type and are available from a number of firms. However, for the greater reliability required for some applications, it will be advantageous to use static limit switches.

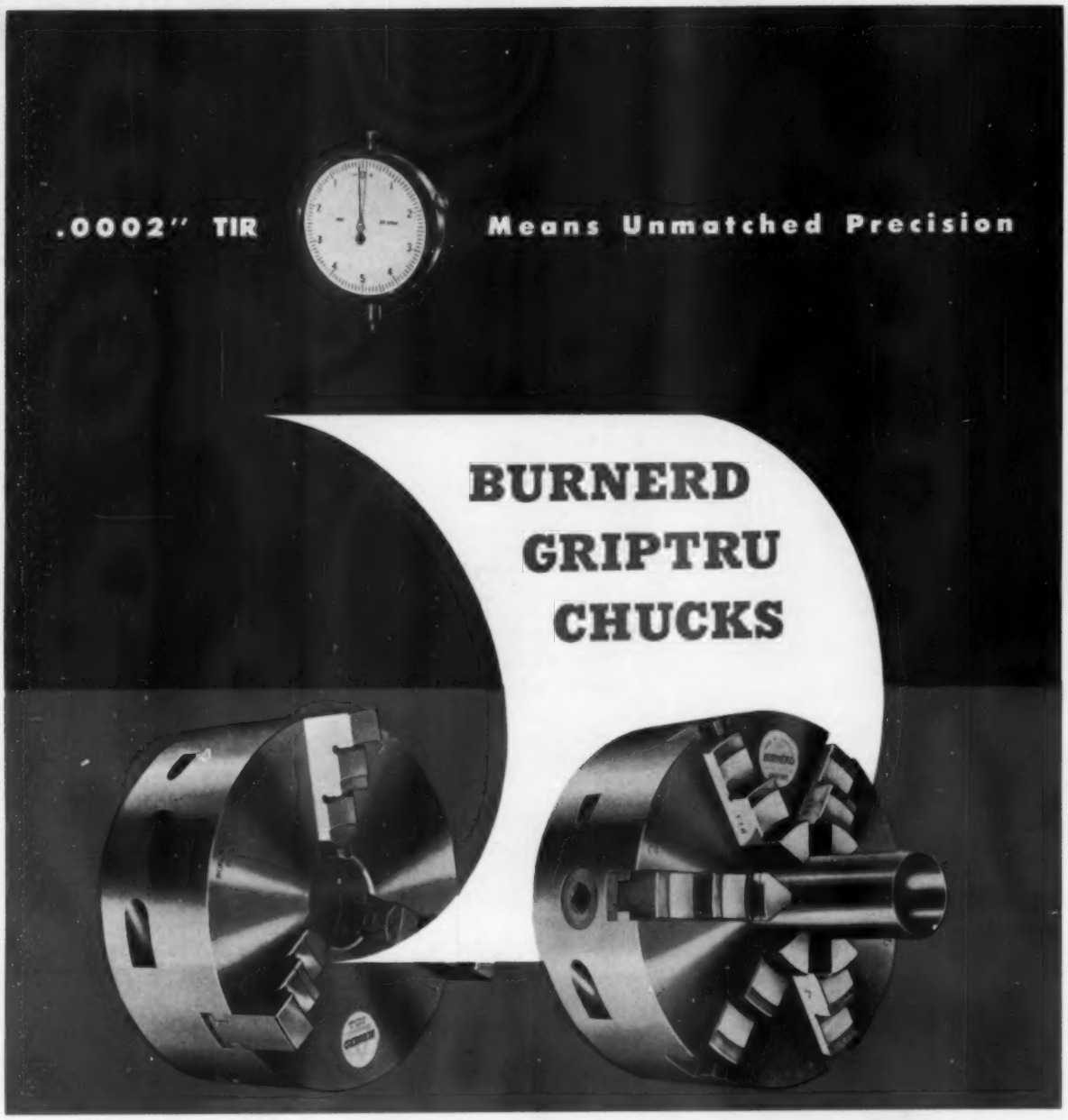
Snap-action switches may fail after anywhere from a few hundred cycles to several million. It is advisable on applications where the switch will be operated on every stroke of the press to have two switches connected in series. This means, for example, that if one normally open switch failed in a closed position, the other normally open switch must be actuated to close the circuit and allow the ram to continue moving. However, most switches in such use will operate infrequently, and normal maintenance is all that is required.



5. Stock Buckling—This type of fault usually occurs during the early part of the feeding cycle. Therefore, the first miscut can easily be avoided. The stock may buckle up or down if it is not restrained in either direction. If this is the case, a pair of switches would be needed to detect the fault. In this illustration, however, the stock can only buckle up and only one switch is required. It is connected to the emergency stop circuit and will immediately cause braking of the ram if the clutch is electric or pneumatic.



6. Repeating Feature Does Not Register—A switch is being used to sense the leading edge of the scrap before it is cut off by a scrap-chopper. In order to function properly, this switch must be connected in parallel with a cam-actuated switch that permits the press to run, except for that portion of the cycle when the scrap-sensing switch is actuated. As explained in the section on switch life, two switches connected in series should be used, because they must operate on every stroke of the press. For the same reason two switches connected in series should be used in the cam-actuated leg of the parallel circuit.



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SHOOTING them into space in satellites must be the most expensive method yet devised to get rid of mice.

Simple Contract

WHEN Peter Studebaker joined his brothers as a partner in Studebaker in 1863 he signed a contract. The contract read in full: "I, Peter Studebaker, agree to sell all the wagons my brother Clem can make. I, Clem, agree to make all he can sell."

Exotic Missile

A color card for industrial finishes that are used (among other things) for missiles, includes such exotic shades as tangerine, maple sugar, and tawny beige.

Wear and Tear

WITH all the talk about machine tools becoming obsolete faster because of acceleration in design, we tend to overlook another important factor. George Bradner has reminded us that the wear and tear on a machine is basically the result of the hours during which the machine *operates*. Twenty years ago the average machine was probably actually cutting metal 30 to 40% of the time on a shift. Now it is likely to be 60 to 80% of the time. In addition a highly productive (and expensive) machine is more likely to be operated on a two- or three-shift basis. Result: a machine burns up its useful economic life at a faster rate.

Did It Work?

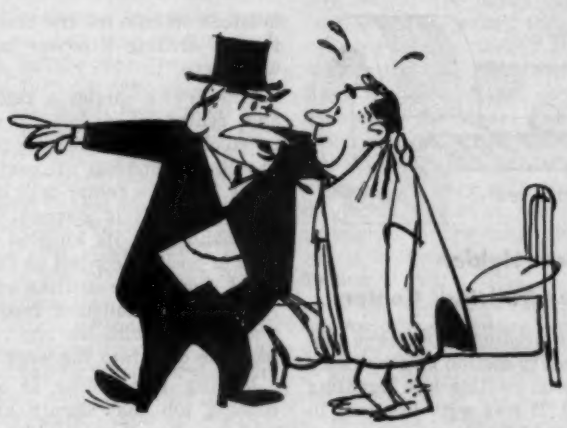
THREE years ago the lead article in this magazine (AM—May 6 '57, p 113) described a method of continuous dress grinding developed jointly by Jones & Lamson Machine Co and Koebel Diamond Tool Co. Wheels are dressed automatically while the grinder is operating using cutters made of cemented diamond particles. Here's how one of the first commercial applications made out:

Three Model E J&L form grinders, each equipped with the perpetual form control device and a set of 16 diamond cutters started operation on transmission-output shafts in September, 1958. The operation was to grind six grooves in one pass from the solid. Each machine has produced 450,000 shafts in the first 20 months, averaging 5,100 shafts per set of grinding wheels. The original diamond dressing wheels are still in the machines. The grinding cycle is 18 sec and the machines have maintained a production average of 90 to 100 pieces per hour including all downtime for cleaning, servicing, and wheel changes.

Direct Action

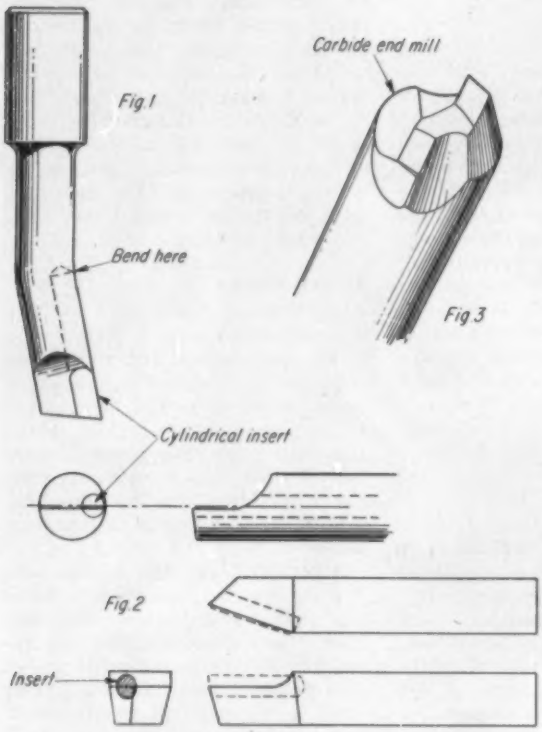
AMOS WHITNEY was a man who dealt with absenteeism in a direct way. If an employe was not at his machine, Whitney drove to the man's home. If the man was ill, he sent for a doctor and provided extra money for the emergency. But if the man was just hung over, Whitney would drag him from bed, toss him in the buggy and take him to work.

Amos Whitney, who joined with Francis Pratt to form Pratt & Whitney a century ago, was from Biddeford, Maine, and only distantly related to Eli Whitney. And if you've ever wondered about there being two Pratt & Whitneys in the Hartford area—one for machines and gages and one for aircraft engines — the answer is that the century-old Pratt & Whitney started developing and building radial air-cooled engines in the early twenties, then sold this division to United Aircraft.



Practical Ideas...

Cylindrical Carbides Offer More Strength and Economy



Have you explored the advantages of cylindrical carbide rods which come in many diameters and lengths? After years of making my carbide cutting tools with flat tips, I have found I get considerably more service out of the rods. They perform longer because of their length, they are easier to mount and, once mounted, they are more secure.

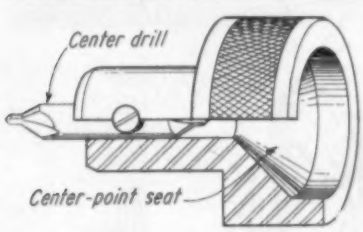
I first started using round carbides, mounted as shown in Fig. 1, in boring bars for jig boring tool steel. These bars are made of drill rod of a diameter to fit the boring chuck. The first step is to turn down the front end to a suitable diameter after which a section, equal to the length of the carbide, is bent to produce tool clearance. In making the hole for the carbide, I spot the location with an end mill and finish the hole with a drill to make sure it barely breaks through the side of the bar. This operation requires a piece of scrap clamped to the side to prevent complete breakout.

The bar and the carbide are now fluxed, the bar is heated and, after silver solder has been run into the hole, the carbide is inserted. Aside from cleaning up the bar, the only preparation necessary is grinding a flat to slightly below the centerline and providing the front-cutting edge with vertical and horizontal clearances. Hardening and drawing the shank will resist its being marred by setscrews which hold it in the boring chuck.

Other round carbides can also be used to advantage in making turning tools. One example, illustrated in Fig. 2, shows how a popular-style toolbit is made. I've found drilling a hole is easier than milling a pocket for a flat insert. In any event, my method doesn't require the use of a milling machine. But, what's more important, a round insert soldered into a hole makes a better bond.

When it comes to milling tough material, a carbide-tipped end mill is the tool usually turned to. However, the inserts are thin and will not stand much abuse and, unless extreme care is taken, they are soon broken or corners are knocked off. A solid carbide, on the other hand, make a very serviceable cutter when ground as shown in Fig. 3. If a tool grinder is available, this is a simple job, but with the aid of a small square to insure squareness and balance, a two-fluted cutter is easy to make free hand.

Barry S Cox, Royal Oaks, Mich



Center-Drill Holder Mounts on Tailstock Center

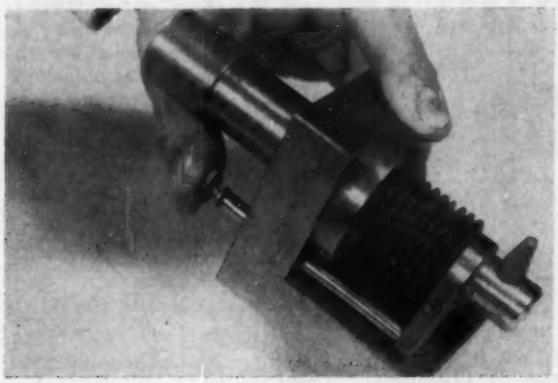
Economy in production requires that all unnecessary motion be eliminated and that intermediate tool handling be reduced. It was with this rule in mind that the tool shown above was designed. It does away with the cumbersome task of changing tools in the tailstock spindle for the brief operation of drilling a center hole in a workpiece.

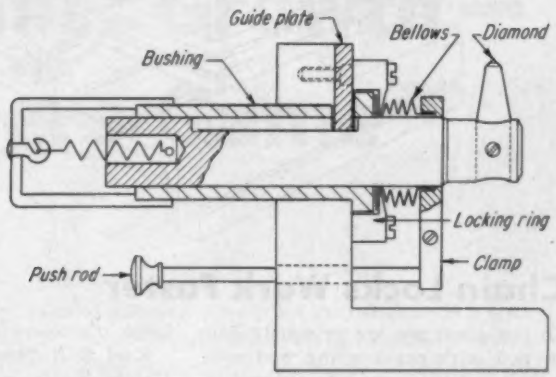
This device carries a center drill and, seated on a live or standard tailstock center, eliminates the usual process of removing the center to replace it with a center-drill holder or drill chuck. It is gripped with the left hand over its knurled OD and held in positive contact on the center point during the drilling operation. As usual, the tailstock feedscrew is manipulated with the right hand to feed the drill into the work.

Making this holder is a simple turning job that hardly needs describing. However, I'd like to point out that the bore for the center drill and the tapered recess, or seat, must be concentric and should therefore be done in one setting. Also, the taper must match that of the tailstock perfectly.

Rolf B Ericson, Trollhattan, Sweden

Angle Dresser Is Completely Protected Against Abrasives





Much contour grinding requires that wheels are dressed, not only to radii of various dimensions, but with different-degree angles. Two types of dressers will then be necessary and there are actually radius dressers that are made to do both jobs, but it is generally felt that they function best at producing radii and are therefore confined to this work. Several types of slide dressers have been introduced but have failed because they were unprotected and receptive to grinding dust.

The illustrated tool, on the other hand, has all its critical moving parts fully protected. It is also comfortable to use and safe as it allows operation away from the wheel and the resultant grit scatter.

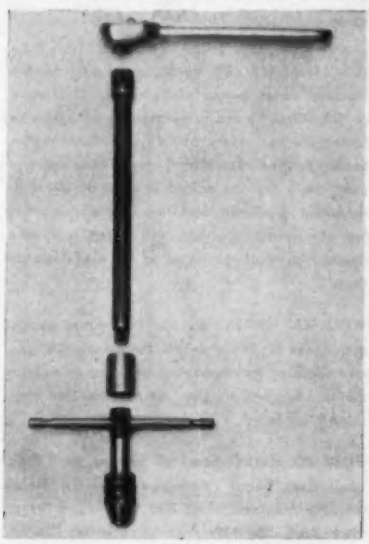
Normally, the tool is used on a sine plate or adjustable-angle plate, but it may also be gripped at the desired angle in a grinding vise. A shop-made rig to which the dresser is permanently attached, could prove to be a worthwhile addition for greater convenience.

The photo illustrates how the dresser is used. A mere push of a rod moves the diamond-carrying spindle forward. Slow, gentle release of pressure allows the spindle's return to starting position.

The spindle is carried in a bushing which is secured in a horizontal position through the upright leg of an angle plate by means of a clamping ring. A guide plate, recessed into the top edge of the angle plate, projects into the bushing to engage a flat on the spindle. This is to keep the sliding motion of the spindle on a straight plane. One end of the return spring is anchored with a pin in the bottom of a hole in the back end of the spindle. The other end is hooked to a dust cap which fits over the end of the bushing.

Passing through the angle plate the push rod is held by a clamp that also grips the spindle and the forward end of a dust cover. The back end of the cover, which is in the form of a bellows, fastens under the bushing-locking ring.

Carl S Frank, Clark, NJ



Tap-Handle Extension

Suppose you had to tap a hole deeply located in a larger hole or between obstructions, and then finding that your tap handle was too short to reach and turn the tap, what would you do? Would you fool around and make a temporary improvization, later to be thrown away, or would you make a slight modification on your present handle so it can at any time be adapted to reach difficult locations? If the latter sounds more practical, here's how you can do it.

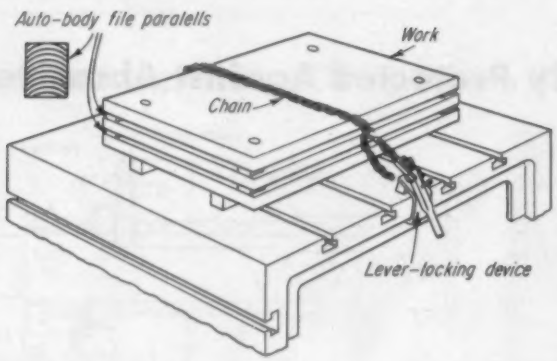
Just remove the T-bar from the handle and mill its shank to a standard hex. This will enable you to extend the handle whenever the need arises. Then, simply slip the proper-size socket wrench onto an regular wrench extension and mount the handle in the socket wrench. The depth to which a handle can thus be extended is unlimited since rods of any length are easily made up if available ones aren't long enough.

Either of two means are used in driving the tap. The ratchet handle from the wrench set can be used (shown in the photo) and is particularly convenient in close quarters. But if you'd like to get the same 'feel' as you have with the tap handle when used as is, just fit a T-bar through a square drive plug and insert it in the drive socket of the extension.

At the bottom of the photo, the tap handle is shown as used under ordinary conditions, with the T-bar in place. In cramped quarters, when the extension is needed, the T-bar is, of course, removed.

T/Sgt USAF Norman P Trahan, Holyoke, Mass

Practical Ideas...



Chain Locks Work Faster

In our plant we are primarily concerned with constructing hydraulic presses. Among the components required in these presses are three platens with four holes, one in each of the corners, which must be drilled and bored in unison. Our previous and most acceptable method of operation was to stack, tack weld, and clamp them to the table of our radial drillpress with long bolts, heel blocks, and straps.

If you bear in mind that each platen weighs no less than 200 lbs, and some of them measure up to 5 x 24 x 48 in., it's easy to see that this in itself was a materials-handling problem. But, what was even more difficult and time-consuming was the job of separating the platens and cleaning up the welds after the holes had been finished.

To do this work more efficiently, we have now adopted the method shown in the sketch. Tack welding has been eliminated by use of small traction parallels made of short lengths of auto-body files having radial cut. Instead of the old clamping setup, a chain with a lever-locking device secures the work to the table. When locking pressure is applied, the stack may shift on the regular parallels at the bottom, but the traction parallels keep the stack in line. Any burrs raised on the corners by the chain are negligible and are easily removed with a file.

This setup consumes but 15 minutes in stacking, locking up, and dismantling, and compares favorably with the four hours previously used for the same operation.

The chain strap is also more efficient for securing other work such as cylinders or solid round stock. This is particularly true where pipe and large diameters are involved.

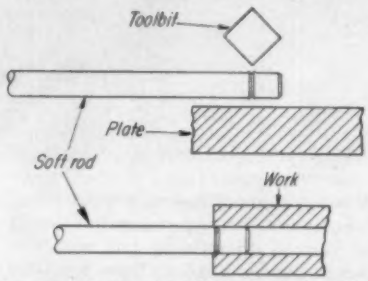
Karl E Hoffmann, shop foreman, Clifton Hydraulic Press Co, Clifton, NJ

Ring Burr Checks Small Diameter Bores

Standard plug gages are of little use in checking small bores for out-of-round or bellmouth. We came to this conclusion after many attempts at accurately gaging the holes in a large number of carbide and hardened-steel bushings. Not only were the holes of small diameters, (0.015 to 0.080 in.) but the limits were also close. The specs called for + 0.0001 − 0.0000 in.

Our eventual solution turned out to be a simple one. For each diameter, we merely turned down and polished a soft steel rod to about 0.001 in. under the hole size. A small ring burr was then raised around the rod by rolling it between a flat plate and the sharp corner of a piece of hardened steel such as a toolbit.

Properly done this produces an evenly distributed burr about 0.001 in. oversize. The rod was then pushed into the bore until the burr had just entered. After the rod had



been pulled out without rotating it, the burr was checked for size and out-of-roundness. The rod was again entered, this time pushing it all the way through after which measurements of the burr were once more taken. By comparing these against the first measurements, bellmouth, taper, and out-of-round were easily detected.

F V Fisher, Fisher Gage Works Ltd, Peterborough, Ontario, Canada

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Edward F Schilling
Pittsfield, Mass
Won $25 for his idea:

THREADED DRILL EXTENSIONS ARE KEY TO SPEED AND ECONOMY in the March 7, 1960 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

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Recent Economic Growth — The Numbers Game

If it truly portrayed recent rates of economic growth in the United States, the report on employment, growth and price levels recently issued by the staff of the Joint (Congressional) Economic Committee would point up scarcely less than a national disaster. Among other things, it would document impressively Premier Khrushchev's crack that "the capitalist steed the United States is riding . . . is worn out."

One of the major findings of the Joint Committee's staff (in the Eckstein Report, named for its staff director Otto Eckstein) is that between 1953 and 1959 the average rate of growth of physical output in the United States was only 2.4 per cent per year. This is scarcely more than half the average annual rate of growth of 4.6 per cent the staff found to have prevailed between 1947 and 1953.

Happily, however, the report does not reflect the basic economic realities. Its finding on relative rates of economic growth for the two periods is a statistical *tour de force* which, by the selection of certain figures and certain dates, distorts the record of America's long-term economic growth.

Playing The Numbers Game

By the selection of appropriate starting and terminal periods it is possible to document almost any rate of economic growth that is desired. The table at the bottom of this page shows you how this can be done. It will also show you how the Eckstein staff worked out its shocking contrast in growth rates. The table is built like a schedule of airplane fares between different cities. The postwar years 1946 through 1959 are put down on two axes. One runs down the left hand column, the other runs across the top of the table. Put your finger on the point where the two axes intersect and you have the average rate of growth for the period covered.

ANNUAL AVERAGE GROWTH RATES OF THE U.S. ECONOMY, 1946-1959*

(Percent increases, starting year to terminal year, of GNP in 1954 dollars)

Starting Year \ Terminal Year	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
1946	X	-0.1	-1.9	-1.2	3.0	3.9	3.8	3.9	3.2	3.7	3.6	3.4	2.9	3.2
1947	X	X	3.8	1.8	4.1	4.9	4.6	4.6	3.7	4.2	4.0	3.8	3.2	3.5
1948	X	X	X	-0.1	4.2	5.3	4.8	4.7	3.6	4.3	4.0	3.8	3.1	3.4
1949	X	X	X	X	8.7	8.1	6.5	6.0	4.4	5.0	4.6	4.2	3.5	3.8
1950	X	X	X	X	X	7.4	5.4	5.1	3.4	4.3	3.9	3.6	2.9	3.3
1951	X	X	X	X	X	X	3.4	3.9	2.0	3.5	3.2	3.0	2.2	2.8
1952	X	X	X	X	X	X	X	4.4	1.3	3.6	3.2	2.9	2.0	2.6
1953	X	X	X	X	X	X	X	X	-1.6	3.2	2.8	2.6	1.6	2.4
1954	X	X	X	X	X	X	X	X	X	8.1	5.1	4.0	2.4	3.2
1955	X	X	X	X	X	X	X	X	X	X	2.1	2.0	0.5	2.0
1956	X	X	X	X	X	X	X	X	X	X	X	1.8	-0.2	2.0
1957	X	X	X	X	X	X	X	X	X	X	X	X	-2.3	2.0
1958	X	X	X	X	X	X	X	X	X	X	X	X	X	7.0
1959														

*Compound rates of growth

Following this procedure, you can find growth rates ranging all the way from —2.3 per cent, between 1957 and 1958, to +8.7 per cent, between 1949 and 1950, along with almost any other rate you would choose for various years and sequences of several years over the postwar period.

For example, if you want to demonstrate that the postwar growth rate through 1953 was less than 4% per year, you take off from 1946, include a drop of 0.1 per cent between 1946 and 1947, and come up with a growth rate for the 1946-1953 period of 3.9 per cent. But if you want to show it was quite high, you take off a year later, from 1947 (which drops out that dismal —0.1 per cent for 1947) and come up with a fine growth rate of 4.6 per cent for the 1947-1953 years.

Statistical Hocus-Pocus

That's what the Eckstein staff did. It took off at one end from a year when there was just about no growth, went to the Korean War boom year of 1953 at the other end, and got that average growth rate of 4.6 per cent. Then it took off from the Korean War boom year of 1953 and ran to the year 1959, when business was recovering from a recession and suffered through a steel strike of 116 days, to come up with its 2.4 per cent growth rate for the second postwar period. As the table indicates, by taking off a year later (1954) the average growth rate would have become 3.2 per cent, and if the take off had been 1949 it would have been 3.8 per cent.

There are those who, in nontechnical terms, would characterize this as statistical hocus-pocus. There are also those who would see in it an element of political hocus-pocus, too. This is because the years 1947-53, when the Eckstein staff found there had been the healthy 4.6 per cent growth rate, were roughly years when we had a Democratic president, while the anemic growth rate of 2.4 per cent it calculated for the subsequent years was for years of a Republican presidency.

Actually it can be shown that the civilian part of our economy has had more rapid growth during the Republican administration than it had during the Democratic years. If military expenditures are subtracted from the national ouput, the resulting growth rate for 1953 to 1959 is slightly higher than for 1947 to 1953.

However, we do not question the *bona fides* of the Eckstein staff. **But we do assert that it has produced a statistical picture of the postwar growth of the American economy which is dangerously misleading both at home and abroad.**

Abroad, the report appears to give official documentation to the propaganda line that the Soviet economy is running rings around the U.S. economy in growth, and that it is Communism a country should choose if it really wants to develop rapidly. Building on a much smaller economic base than the U.S.A., the Soviet Union — as well as almost every less advanced nation in the world — is bound to show a larger percentage increase in output than the U.S.A. But the Eckstein staff calculation gives the Communists ammunition they don't deserve.

Are We Facing A Crisis?

The contrast drawn by the Joint Committee staff in postwar U.S. growth rates suggests that we are facing scarcely less than a crisis through paralysis of our economic growth which calls for drastic remedies. But this, as the full 1947 to 1959 growth record set forth in the table makes clear, is very definitely not the case. Our over-all postwar rate of growth, as measured by the gross national product in physical terms, has been 3.5 per cent per year, a rate nearly double the long-term growth rate of 2 per cent per year between 1909 and 1939. In the continuing fluctuations in the rate of growth which more or less inevitably characterize a relatively free economy, we have had some downs in recent years. **But our economy is now on the upbeat again. And at the end of this year, the U.S. economic growth rate for the postwar period can be expected to be 3.7 per cent per year.**

It is extremely important for the United States to continue to maintain this rate of economic growth or even to surpass it. Upon this effort depends our capacity to meet our defense requirements without dangerous strain, to provide an adequate margin for foreign aid, to improve our own productive facilities, and to continue to raise our own standard of living.

How not only to maintain but possibly improve upon our postwar pace of economic growth will be the subject of strenuous debate in the months ahead. However, the debate will have a much better chance of being constructive if the postwar growth record is seen in proper perspective. To this end one of the first things to do is to junk panic rousing statistical portrayals such as that in the Eckstein report.

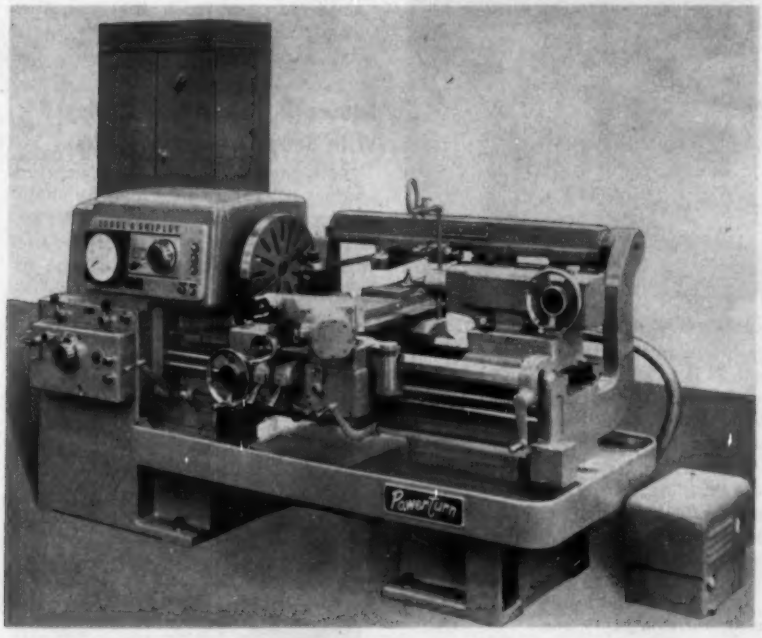
This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

New Shop Equipment
Materials and Parts



Universal Constant Cutting Speed Lathe Eliminates Special Speed Control Cams

Lodge & Shipley's Powerturn 45° Copymatic models 2013 to 3220-37 provide constant cutting speed at any point, regardless of contours. Besides giving greater accuracy and smoother finish, the new lathes eliminate the cost and delay of providing a special speed control cam for each job, give longer tool life, and minimize grinding.

The lathe headstock is equipped with a 24-speed transmission plus a variable speed drive which permits infinitely variable control of each speed, with automatic and/or manual speed control. Even in automatic operation, the operator can manually trim the spindle speed. If the spindle speed is not the exact value required for desired surface speed at a given diameter (as controlled by the carriage-mounted potentiometer), the manual constant speed potentiometer can be adjusted to bring the spindle speed to the desired rpm.

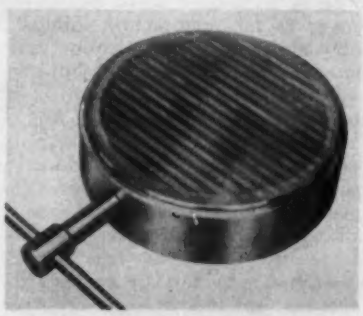
This machine, with an operation technique Lodge & Shipley calls combined feeds, gives machining capacities greater than on conventional tracer lathes. Combined feed engages longitudinal and cross feed simultaneously to give a straight tool path in a line termed the mean of the contour. Then, the hydraulic cylinder needs only to provide for the differences from this path to the actual contour being machined. Conventional feed combination (a 1:1 ratio) gives a tool path at 45° to the centerline, but the ratio can be varied to provide a resultant tool path at 10° or even 5° to the centerline. Such ratios are ideal for venturi shapes, nozzles, and other long, slender workpieces with relatively large diameter changes.

Other new features on the lathe include: End gearing to permit reduced feed rates for extremely critical surface finishes; a cross-center facing arrangement that automatically brakes and stops the spindle as the tool reaches the centerline, reverses, and restarts spindle rotation—at the same time, feed direction is reversed and the tool continues feeding to the back side of center, all under tracer control; a special swivel arrangement which permits mounting of an integral type spindle for contour grinding; a modification of this device adaptable to electrolytic grinding of the new exotic materials.

In addition to all the special equipment mentioned, each lathe can be used as a standard tracing lathe at any time.

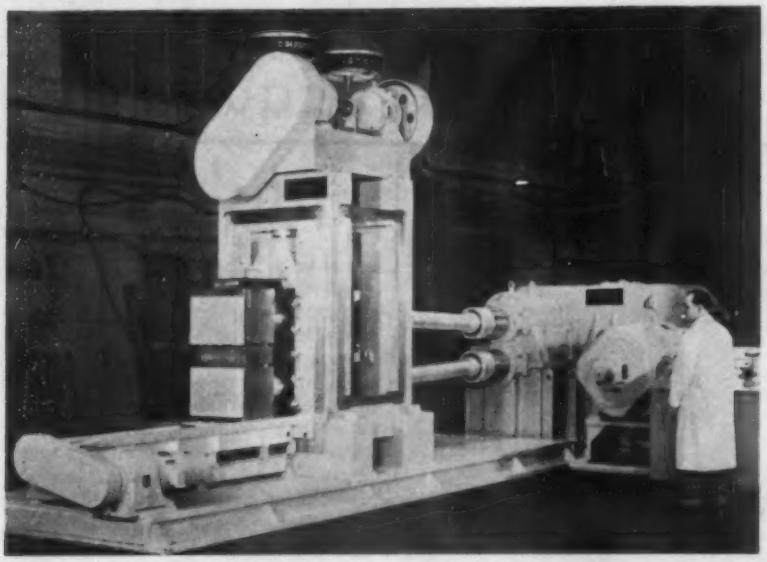
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

MORE DATA? Circle 51, inside back cover



CERMAX ROTARY CHUCK is said to be powerful enough to be used for lathe work. Holding power can be varied. No electrical accessories are needed —*O S Walker Co, Rockdale and Woburn Aves, Worcester 6, Mass*

MORE DATA? Circle 52, inside back cover



REMOTE CONTROL ROLLING MILL for operation within an airtight steel enclosure vessel will produce plutonium-alloy fuel elements for the Plutonium Recycle Test Reactor at Hanford, Washington. It is a 20-in. wide, 2-high/4-high mill with 3-in. dia work rolls and 14-in. dia backup rolls—*Loma Machine Mfg Co, Inc, NY 16, NY*

MORE DATA? Circle 53, inside back cover

Adjustable-Speed AC Drives Rated From ¼ to 100 hp

Magnaflow electromagnetic drive, of integral-unit construction, is designed to apply adjustable speed power to conveyors, fans and pumps, winders, and metal slitting and forming machines; it can be used practically anywhere that speed control is needed.

Drive can be set before or during operation to deliver any desired speed within its range. Not only can speed be adjusted quickly and easily, but it remains adjusted. Built-in tachometer monitors the output speed and automatically corrects it, regardless of any change in load. Standard excitation and regulator controls for air-cooled drives up to 30 hp measure only 9¾ by 8¼ by 24¼ in. Control units provide speed regulation accurate within ± 2% of top speed. Because of the extremely small excitation requirements, drives are adaptable to either electronic or magnetic amplifier excitation control. Simple control modification to provide a variety of speed operating functions are available.

Westinghouse Electric Corp, PO Box 2099, Pittsburgh 30, Pa.

MORE DATA? Circle 54, inside back cover

New Dual Shield Welding Products Introduced by NCG

An arc welding control with wire drive, and an arc welding torch, are both designed for consumable electrode welding processes using shielding gases such as argon, helium, or carbon dioxide in making horizontal fillets and flat position welds. They can be used with dc welding current in Dual Shield or other semi-automatic welding processes.

The skid-mounted 55-lb WC-1 control is designed to avoid intricate electronics. Control motor with a governor replaces electronic components for the wire drive. Control has a wire feed rate of from 55 to 500 ipm for 3/64 to 3/32-in. wire. Double gate wire drive unit provides positive drive and tends to straighten wire as it passes through the unit. The AM-1 torch with interconnecting gas, water, and flexible conduit assemblies, is designed to complement the WC-1 control but may be used with other controls.

National Cylinder Gas Division, Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill

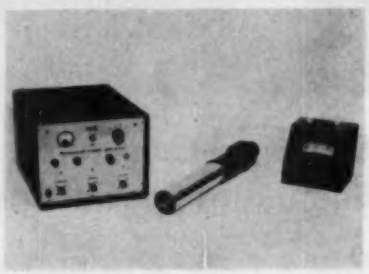
MORE DATA? Circle 55, inside back cover

Square D Timers Now Equipped With Snap-Switch Interlocks

Type B and C timers have increased contact reliability provided by snap-switch interlocks. Timers, with an adjustable range of up to three minutes, can be furnished with one or two single-pole double-throw instantaneous interlocks which are also available for installation by the user. Both timer head and magnet assembly are front-removable; they can be replaced without removing the complete timer from panel.

Square D Co, 4041 N Richards St, Milwaukee 12, Wis

MORE DATA? Circle 56, inside back cover



Electronic Auto-Collimator Reads Angles to 1/50 Second

Electronic auto-collimator, said to read angles directly to a sensitivity approaching 1/50 of a second, can be used to check the flatness of surface plates, for monitoring drift of gyros, for checking straightness of machine tool ways or for checking runout of bearings.

Components are a sensing unit, a power amplifier and an indicator. The sensing unit transmits the signal (angular deviation) through the amplifier to the remote indicating unit. Indicating range is ± 25 seconds with a working distance of up to 30 ft between sensing unit and reflecting surface.

Optics and Metrology Div, Keuffel and Esser Co, 3rd and Adams Sts, Hoboken, NJ

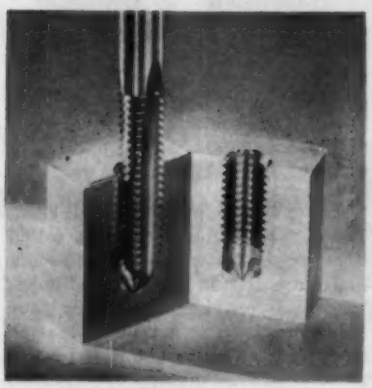
MORE DATA? Circle 57, inside back cover

Cutting Compound Prevents Galling Of Cutting Tools and Workpieces

No-Gall is designed for use in broaching, tapping, and threading. In tapping operations involving cast SAE 4140 steel of R_c 35, tap life was tripled and surface finish on workpieces considerably improved as compared with results obtained with other cutting oils and compounds. Product is applied directly to the cutting tool edges by brushing. Two-ounce samples may be obtained at no charge.

No-Gall, Hal Industries, Box 224, Wyckoff, NJ

MORE DATA- Circle 58, inside back cover



Fluted Tap Introduced For Chipless Cold-Forming

Fluted tap designated Jar-Flo FT forms threads without chips. Prior to this development, according to the manufacturer, cold-forming taps were fluteless and required more than ordinary torque to drive them. By fluting the tap, the contact area has been reduced, thus lessening drag and reducing driving torque. Fluting also allows lubricant to move directly to the forming area to provide longer tap life and smoother threads.

Jarvis Corp, Tap Subsidiary, North Attleboro, Mass

MORE DATA? Circle 59, inside back cover

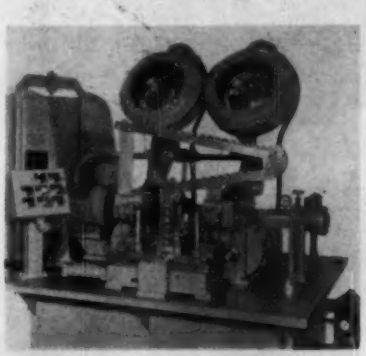
Color-Coated Steel Offered In Nine New Colors

New line of colors is available on 26-gage panels, 36 in. wide, and in any lengths desired. They are designed for use on walls and roofs, or as an accent material with brick, wood, stone, or glass.

The factory-applied, baked-on color reportedly won't chip, peel or fade. It is a vinyl-aluminum or vinyl-base color coating applied in multiple layers over a galvanized zinc coating, and a clear adhesive bond coating. Of the nine colors, seven are basic white, light blue, deep blue, light green, mist green, light gray, slate gray. Two accent colors, orange and yellow, can be used in highlighting a specific area.

Stran-Steel Corp, Div of National Steel Corp, Detroit 29, Mich

MORE DATA? Circle 60, inside back cover



BEARING ASSEMBLY MACHINE loads 22 needle rollers into automotive transmission gears at a rate of 2200 assemblies per hour. Hydraulically operated reciprocating slide permits loading of a gear at each index of the slide—*Rehnberg-Jacobson Mfg Co, 2135 Kishwaukee St, Rockford, Ill*

MORE DATA? Circle 61, inside back cover

Ultrasonic Transducers Mounted On Bottom of Cleaning Basket

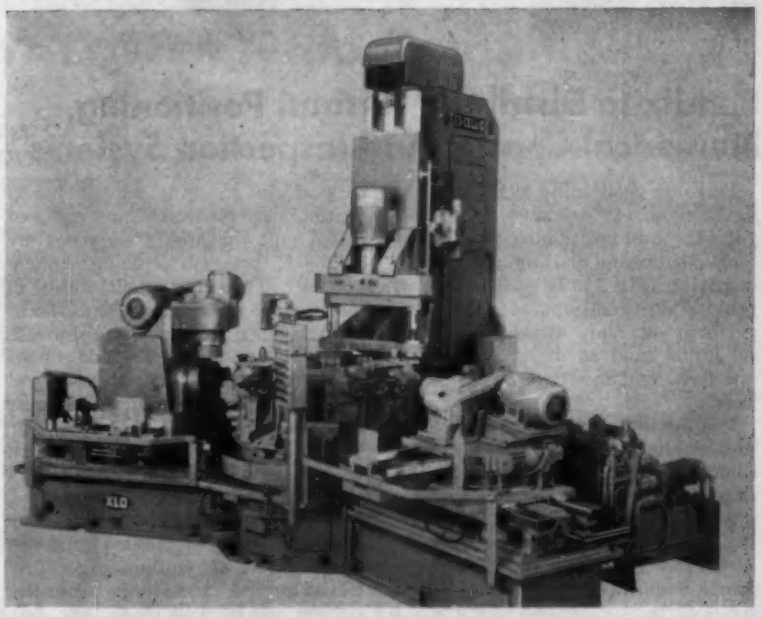
Stainless steel basket with barium titanate transducers sealed in the bottom can be submerged in almost any solution and used as an ultrasonic cleaner when connected to a Model PG125 generator.

The Model CB125 basket has an operating frequency of 40 kc and can use either regular 180 F transducers or high temperature 300 F transducers. It measures 9½ by 9½ by 33 in. high and weighs 16½lbs.

The generator, measuring 14 by 10 by 10¼ in., has a 125-w average output with a 250-w peak.

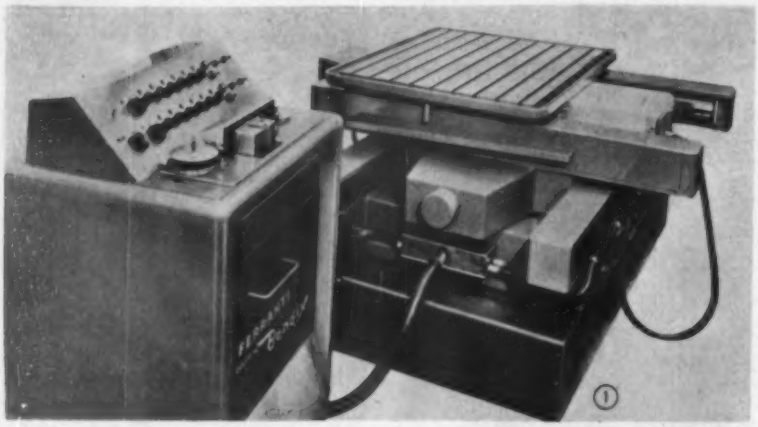
Circo Ultrasonic Corp, 51 Terminal Ave, Clark, NJ

MORE DATA? Circle 62, inside back cover



ROTARY INDEX MACHINE processes exhaust manifolds for trucks at a rate of 133 per hour. Operations include rough and finish milling the joint face pads; drilling all mounting holes, core drilling and chamfering—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich*

MORE DATA? Circle 63, inside back cover



Bendix to Distribute Ferranti Positioning, Numerical Control And Inspection Systems

Ferranti positioning system, made in England, is designed for rapid point-to-point positioning of work on tools performing drilling, machining, or boring (Fig. 1). In addition it can provide up to 25 separate signals to perform auxiliary machine control functions such as down feed, coolant flow, and feed and speed selection.

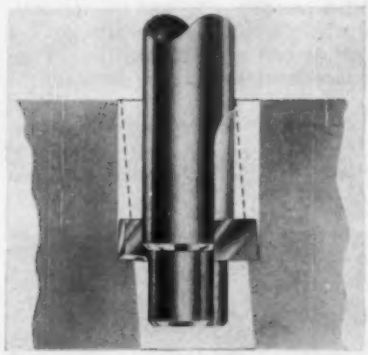
Positioning data is in the form of absolute coordinates: two sets of dials, one for each X and Y coordinate, permit the operator to select any coordinate position up to 99.9999 in. The system provides positioning feed rates up to 200 ipm, and electronic resolution may be as small as 0.000040 in.

The contouring-type control system (Fig. 2) is designed for application to two and three axis small and medium size machine tools. Accuracy of the machine movements is continuously controlled and checked throughout machining sequence by feedback system utilizing optical gratings. These permit flexibility in selection of power drive since accuracy is dependent upon the gratings and not upon loadbearing lead screws or cylinders. Each reel of tape gives total machining time of three hours and ten minutes.

The Ferranti inspection machine (Fig. 3) cuts time of inspecting work pieces compared with conventional indicator, height gage and surface plate checking methods. This versatile piece of equipment utilizes transistorized electronic counting circuits and optical measuring gratings to inspect machine parts by the coordinate method to an accuracy of 0.001 in. Measurment information is presented continuously on two five-figure groups of numbers. Inspection probe can be moved 24 in. in longitudinal direction and 15 in. in transverse direction; vertical probe travel of 12 in. is provided.

Ferranti, Ltd., Dist by Bendix, Industrial Controls Section, 21820 Wyoming Ave., Detroit 37, Mich

MORE DATA? Circle 64, inside back cover



Cutter Said to Eliminate Core Drift in Boring Cored Holes

Line of adjustable cutters, called Core-rector Cutters, are said to eliminate core drift in boring cored holes. They will provide a perfectly true hole even though the cored hole itself deviates from centerline in the workpiece. The tools incorporate a special grind to eliminate the deflection normally encountered in machining off-center cored holes by conventional methods. They can be used on turret lathes, bar automatics, chucking machines, boring mills, vertical turret lathes or radial drills.

Muskegon Tool Industries, Inc, 11th at Western, Muskegon, Mich

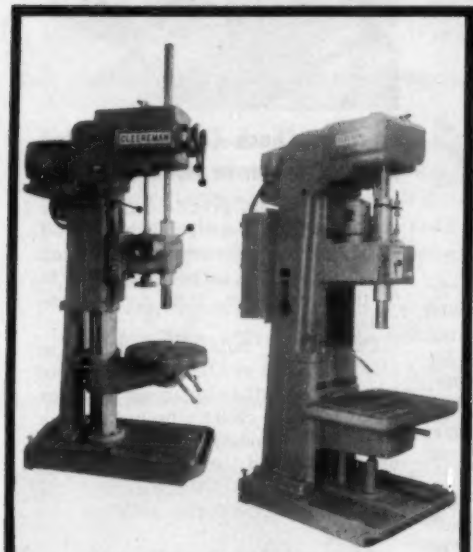
MORE DATA? Circle 65, inside back cover

Unit Converts Standard Welder For Inert Gas Arc Welding

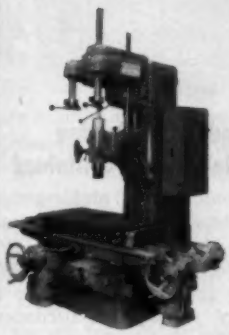
High-frequency stabilizer is designed to convert any standard ac or dc welder for inert gas shielded arc welding on aluminum, stainless and

CLEEREMAN

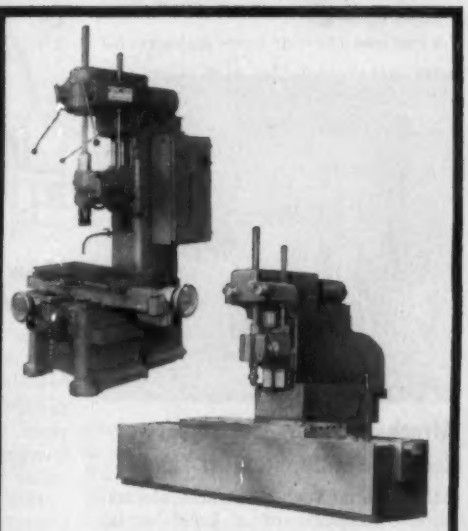
BUILDS ALL THREE!



Sliding Head and Automatic Cycle Drilling Machines



Precision Jig Borers



Automatic Positioning, Numerically Controlled and Standard Layout Drilling Machines

–TO EXACTING PRECISION STANDARDS FOR PRECISION PRODUCTION AT LOWER PRODUCTION COST.

ROUND COLUMN AND BOX COLUMN SLIDING HEAD DRILLING MACHINES produce accurate holes economically at high speed, and are general purpose machines which stand up under extreme production schedules. Box Column Machines have exceptionally rigid construction for accuracy and speed on continuous heavy duty work. The Series A or Automatic Cycle Drilling Machine is capable of producing small or large production lots at a minimum cost. All Drilling Machines are furnished as single spindle, multiple spindle or gang drills.

STANDARD AND NUMERICALLY CONTROLLED LAYOUT DRILLING MACHINES handle work with tolerances ±.001″ per foot or broader, with extreme convenience in drilling, boring, tapping, reaming and milling for jigless production. The Automatic Positioning Layout Drilling Machine permits precision machining in hole patterns requiring ±.0002″ per foot. A single pushbutton controls positioning of table and carriage without manual adjustment. Production lots are machined at a high rate without expensive jigs and fixtures.

JIG BORERS have unexcelled precision for ultra-fine tolerances on highest quality gage, tool, die, jig and fixture work, and on jigless production. They combine stamina with precision and ease of operation for economical small lot production without layout time or jigs and fixtures. Prepositioning power rapid traverse is available on all models.

CONTACT YOUR NEARBY CLEEREMAN DISTRIBUTOR or phone, wire or write direct

CLEEREMAN MACHINE TOOL CORP.

GREEN BAY, WISCONSIN

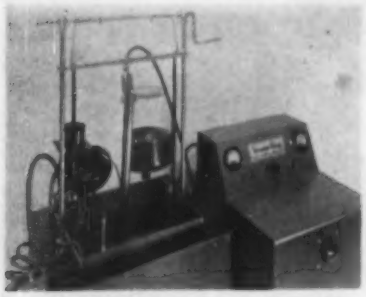
General Distributors: The Jackson-Fotsch Company • 7350 West Lawrence Avenue • Chicago 31, Illinois

alloy steels, copper, magnesium and dissimilar metals.

The unit supplies the arc starting and stabilizing current without electrode contact with the work. It controls high frequency, gas flow, water and post gas flow by a single switch which can be mounted remotely. The 0 to 600-amp stabilizer operates from a 230-v source.

Metal and Thermit Corp, Rahway, NJ

MORE DATA? Circle 66, inside back cover



Attachment for Electroplaters Reduces Set-Up, Stop-Off Time

Attachment for toolroom electroplaters consists of a hoist which raises and lowers a plastic coated table into a self-controlled hard chrome plating solution. This table holds the parts and acts as a current deflector preventing buildup on ends and edges of parts being plated.

Three models of electroplaters, designated K-50, K-100 (illustrated), and K-250 have tank capacities (respectively) of 6 gal work solution, 12 gal, and 24 gal.

Krome-King Division, National File Co, 530 N Cedar St, Lansing, Mich

MORE DATA? Circle 67, inside back cover

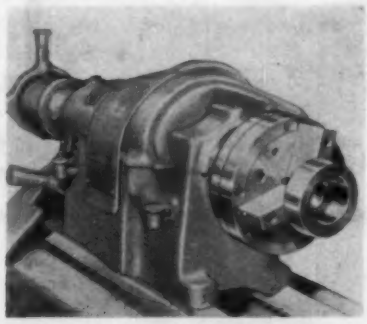
50-kw Induction Melting Power Unit Is Self-Contained

50-kw combination motor-generator and control unit, the Integral 50, contains the entire power supply, capacitors, control and safety devices to operate one or two high-frequency induction furnaces or coils.

The unit contains an eight-step transformer and 32-position capacitor switch to meet any heating or melting requirement. Installation requires only a 60-c 220 or 44-v power connection, cold water connection and a drain.

Inductotherm Corp, 412 Illinois Ave, Delanco, NJ

MORE DATA? Circle 68, inside back cover



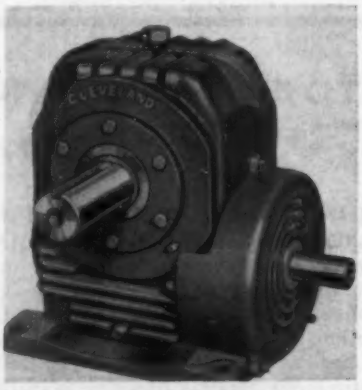
Precision Chuck Can Be Operated By Air Cylinder or Hand Lever

Model 1000 5-in. precision chuck for use on lathes, boring machines and grinders is supplied with blank top jaws which are to be bored out to fit the workpiece. It is accurate to 0.0005 in.

Capable of holding work up to 3½ in. dia ID or OD, the chuck can be operated either by an air cylinder or by a lever collet closer. It has a ¾-in. hole through it to permit coolant to be piped through the spindle. The face of the 8½-lb chuck extends only 1⅜ in. over the edge of the spindle.

Powergrip, Inc, Rockfall, Conn

MORE DATA? Circle 69, inside back cover

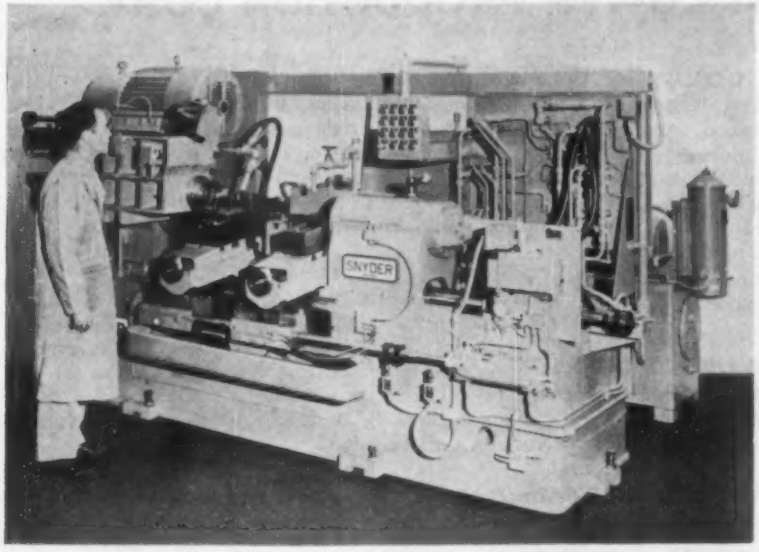


Worm Gear Speed Reducer Transmits 80% More HP

New line of speed reducers is capable of transmitting up to 80% more horsepower than carried by conventional worm gear units, according to the manufacturer. Use of fan cooling, centrifugally cast bronze gears and special heat-treating technique on alloy steel worms permit substantially higher input horsepower and output torque ratings with smaller units.

Cleveland Worm and Gear Div of Eaton Mfg Co, Cleveland 10, Ohio

MORE DATA? Circle 71, inside back cover



HEAVY-DUTY AUTOMATIC LATHE rough turns and faces eight lengths and diameters of forged steel automotive axle shaft with carbide tools at a rate of 105 pieces per hour—*Snyder Corp, 3400 E Lafayette , Detroit 7, Mich*

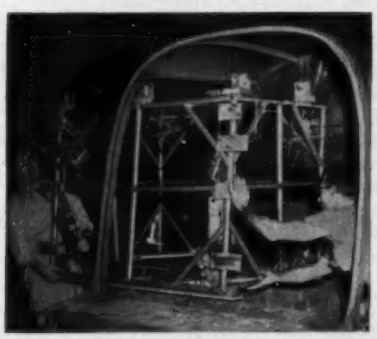
MORE DATA? Circle 70, inside back cover

DOW | *Now in magnesium and aluminum*

MAGNESIUM TOOLING PLATE CUTS TOOLING COSTS FOR MAJOR INDUSTRIES

Magnesium tooling plate and extrusions have become accepted as essential tooling materials during the past six years by such cost-conscious industries as automotive, aircraft, missile, machine tools, and electronics. No other tooling material approaches magnesium's unique combination of cost-cutting properties . . . lightness, machinability, flatness, rigidity. You get more metal per pound with magnesium than with any other metal!

Unmatched machinability cuts machining costs.



Magnesium assembly jig is easily handled by two men.

BEST PROOF of magnesium's acceptance as a tooling material is its actual use for: assembly jigs; trim and drill jigs; checking fixtures; templates; base plates; test equipment. Magnesium's acceptance is growing for a very good reason—its properties mean lower tooling costs, better all-around results!

LIGHTWEIGHT magnesium tooling is easy to build, use and handle, reducing fabrication and labor costs. This is the lightest of all structural metals, weighing only one-quarter as much as steel, one-third less than aluminum. Magnesium reduces worker fatigue and accidents, too.

MACHINABILITY. Magnesium is the easiest to machine of all structural metals, for all machining operations . . . sawing, milling, planing, boring, tapping and threading, etc. For example, cutting speeds of up to 5000 feet/minute and cuts of 0.500" in depth are often used in turning. Even at these speeds and cuts, tool wear is less than with other metals.

FLATNESS. Lightweight tooling plate now has closer flatness tolerances than ever before—so close, in fact, that it can be used *as purchased* for nearly every tooling purpose. Surface machining is not necessary! This plate is rolled and stress relieved, and magnesium's dimensional stability *keeps* it flat.

SQUARE MAGNESIUM TUBING is the latest magnesium extrusion shape. This useful form fills out the complete line of extrusions which includes channels, tubing, and most other standard structural shapes.

• • •

Economical magnesium tooling materials have been proved and accepted by the country's major industries. Why not put their advantages to work for you? For a copy of the fact-filled booklet "Magnesium Tooling Plate Shop Manual," or for more information, contact the nearest Dow sales office or write THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1031F5-16.

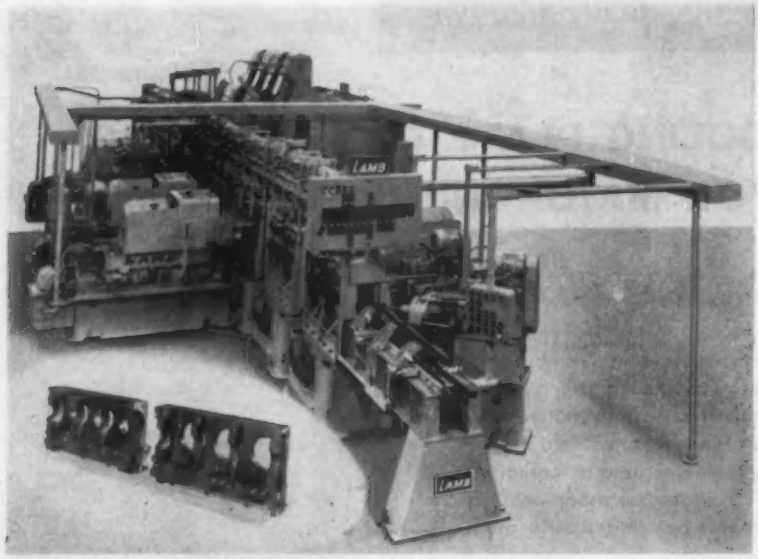
Auto checking fixture retains dimensional accuracy.

Square magnesium tubing is now available.

See "The Dow Hour of Great Mysteries" on NBC-TV

DOW **THE DOW METAL PRODUCTS COMPANY**

Division of The Dow Chemical Company



TRANSFER MACHINE processes both halves of two-piece automotive crankcases at a rate of 120 pairs per hour. Operations are: drill, ream, chamfer, probe, tap, mill bearing lock notches and straddle mill bearing bosses—*F Jos Lamb Co, 5663 E Nine Mile Rd, Detroit 34, Mich*

MORE DATA? Circle 72, inside back cover

Zero-Max Redesigns Line Of Variable-Speed Drives

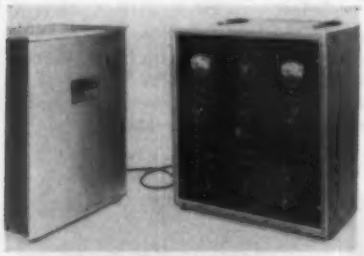
Redesigned Zero-Max drives, designated the 400 Series, have built-in overload protection and a faster, more precise speed setting control.

Other features include a larger input shaft on the smaller models, wider mounting pads and double-slotted holes, 40% less heat rise over ambient, improved gasketing and oil seals, control lever that can be mounted in four positions and ability to mount the drive in any position.

Zero-Max drive has an output range from 0 to 1200 rpm with 1800-rpm input. Speed settings can be changed instantly even while running and instant reverse or neutral can be supplied. It provides smooth, stepless drive with 3 to 450 in.-lbs constant torque. Lever, screw, vernier or remote controls are available. There are over 250 models in the new line available with or without motors from ⅛ to ¾ hp.

Zero-Max Co, 1900 Lyndale Ave S, Minneapolis 5, Minn

MORE DATA? Circle 73, inside back cover

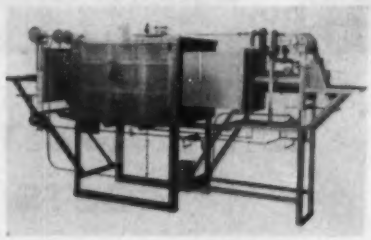


Ultrasonic Cleaner Offered For High Energy Density Jobs

Model 260 added to manufacturer's line (*AM/MM*—Feb 8 '60, p 158) is equipped with a 12-gal tank that is 16 in. long, 16 in. deep, 12 in. wide. Driving elements cover 50% of the bottom of the tank; actual radiating surface is 96 sq in. The 115-v ac single-phase 60-c generator, designed for continuous operation, delivers an average power output of 500 w and produces peaks of 2000 w. Price is $1750.

National Ultrasonic Corp, 111 Montgomery Ave, Irvington, NJ

MORE DATA? Circle 74, inside back cover



Hayes Offers Electric Furnaces For High-Temperature Application

Series of compact research and production furnaces called Hayes Type M-Y provide uniform heat for applications requiring temperatures to 3300 F. Units, which incorporate molybdenum-wound elements, can be used with a variety of non-oxidizing, reducing, or inert atmospheres. They are recommended for ceramic metallizing, specialty sintering, silicon depositing and diffusing, and for developing new heat treating techniques in ceramics, electronics, and other close-tolerance, high-temperature applications.

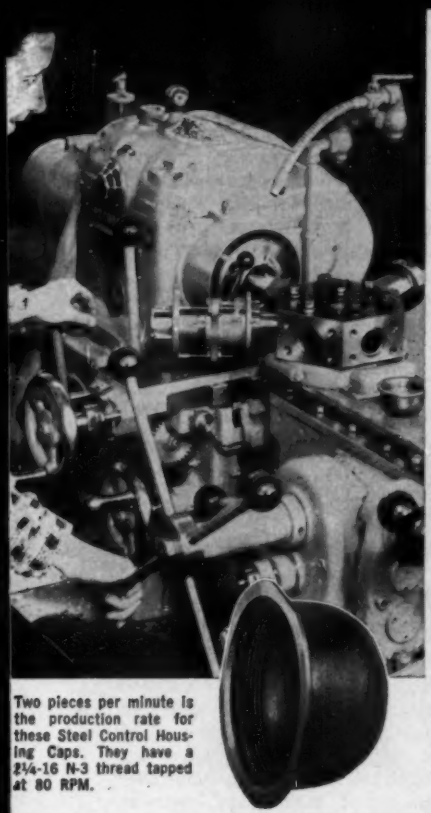
Features include moly-wound muffle for maximum length of temperature uniformity; water-jacketed cooling sections with precise temperature regulators for optimum control of atmosphere cooling; extended insulated throat areas to minimize thermal shock; special atmosphere arrangements to obviate atmosphere contamination; and automatic feed mechanisms.

C I Hayes Inc, 810 Wellington Ave, Cranston 10, RI

MORE DATA? Circle 75, inside back cover

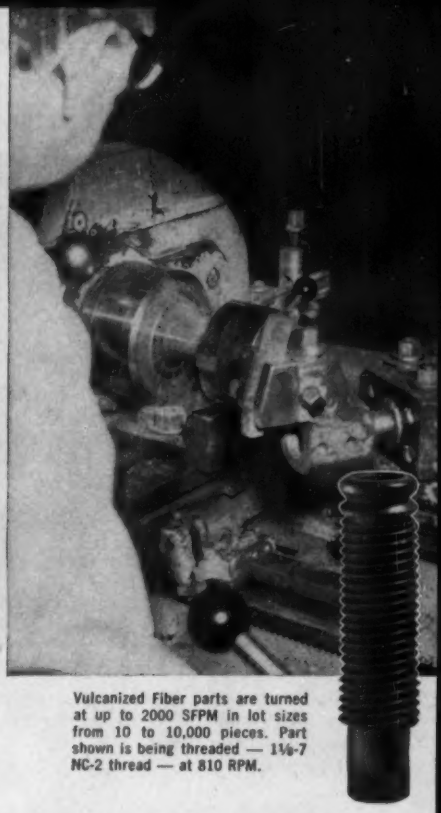
ELEVATING FEEDER orients and feeds parts either right or left. It can be supplied with either fixed or variable-speed drive and automatic controls for demand feeding—*Detroit Power Screwdriver Co, 2801 W Fort St, Detroit 16, Mich*

MORE DATA? Circle 76, inside back cover



Two pieces per minute is the production rate for these Steel Control Housing Caps. They have a 2¼-16 N-3 thread tapped at 80 RPM.

Aluminum Valve Bodies are machined at 610 RPM—500 SFPM. Special tooling enables machining of five surfaces in only one operation — at tolerances of ±.001-inch!



Vulcanized Fiber parts are turned at up to 2000 SFPM in lot sizes from 10 to 10,000 pieces. Part shown is being threaded — 1⅛-7 NC-2 thread — at 810 RPM.

Here's Real Turret Lathe Flexibility...

No. 2 Bardons & Oliver handles steel, aluminum and vulcanized fiber jobs efficiently, economically

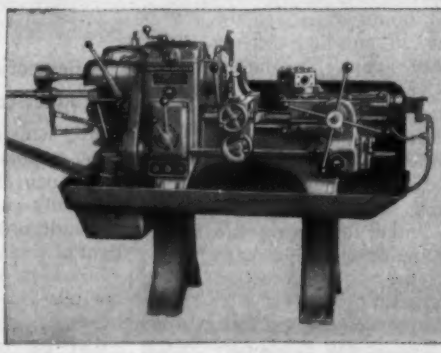
Photos above show the wide variety of materials being machined today on Bardons & Oliver No. 2 Geared Electric Turret Lathes. With these versatile production-boosting machines you can handle either bar or chucking jobs—up to 3500 RPM!

Check these exclusive features—offered on the B & O No. 2—that enable progressive shops to increase production, cut costs.

- SINGLE LEVER SPINDLE CONTROL WITH DIRECT READING SPEED DIAL for six geared speed changes.
- SINGLE LEVER ELECTRIC STOP-START-REVERSE with capacity to 10 cycles per minute.
- SINGLE LEVER ELECTRIC HIGH-LOW SPEED CHANGE with instantaneous, effortless response to the operator's touch.
- SINGLE LEVER CONTROL WITH DIRECT READING FEED DIAL for six feed changes.
- DIRECT FLANGE-MOUNTED HIGH TORQUE MOTOR WITH INTEGRAL DYNAMIC BRAKE. No belts, pulleys, or belt idler.
- RIGIDITY AND STRENGTH WITHOUT EXCESS WEIGHT to increase productive capacity while decreasing operator fatigue.

Since Bardons & Oliver produce a complete line of advance-designed turret lathes, our engineers can recommend the *correct* machines to handle your most varied and exacting jobs. Check with your Bardons & Oliver representative and be shown how these rugged lathes can help increase your overall profit picture.

Bardons & Oliver, Inc., 1133 West 9th Street
Cleveland 13, Ohio



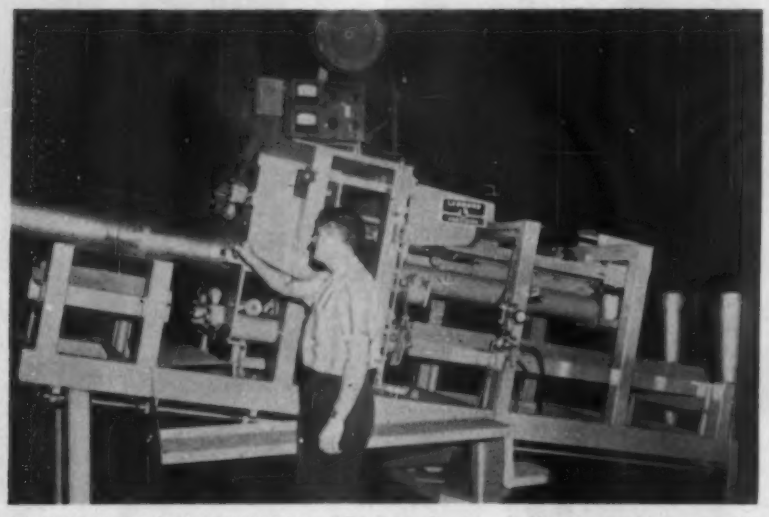
MACHINE SPECIFICATIONS

- 1" or 1¼" Bar Capacity.
- 13½" Swing Over Bed
- 8½" Swing Over Cross Slide
- All Geared Headstock
- Spindle speeds up to 3500 RPM

BARDONS & OLIVER

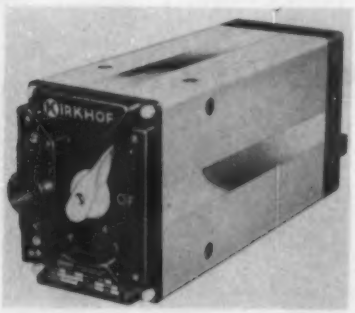
Write for your copy of Illustrated Brochure on the Bardons & Oliver No. 2 Geared Electric Turret Lathe.

Manufacturers of a Complete Line of Turret Lathes and Cutting-Off Lathes



CONTINUOUS SEAM WELDER welds water heater shells at speeds up to 200 ipm. The machine, which uses a water-cooled backup behind the welds, handles tanks from 12 to 20 in. dia—*Leonard Precision Products Co, 9200 Bolsa Ave, Santa Ana, Calif*

MORE DATA? Circle 80, inside back cover



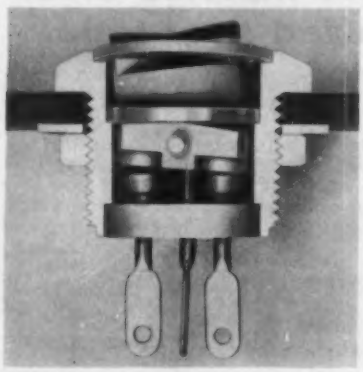
Epoxy-Pak Welding Transformers Provide Added Thermal Capacity

New line of epoxy-insulated units has ratings of 60, 70, 90, and 130 kva. Although thermal capacities of the four basic models based on the previous standard temperature rise of 85 C are 50, 60, 70, and 100 kva respectively, the epoxy insulation makes a 110 C rise completely safe and practical for high production welding. Manufacturer reports that with the higher ratings the user gets a bonus of from 17 to 30% in useable thermal capacity. Additional advantages include longer operating life without maintenance or replacement and better, built-in protection against intermittent overloads.

Largest capacity unit in the line, rated for 130 kva at 110 C temperature rise, is reported to be the first welding transformer with this capacity ever offered in a compact package that conforms to RWMA and JIC cross-sectional dimensions standards, 9¼ in. high, 7¼ in. wide. Overall length of the welding transformer is 21 in.

Kirkhof Mfg Corp, 2450 Buchanan Ave, SW, Grand Rapids 7, Mich

MORE DATA? Circle 81, inside back cover



Switch Is Hermetically Sealed, Magnetically Actuated

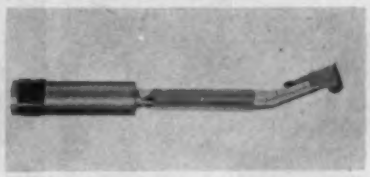
Hermetically sealed FluxLink switch, actuated by a specially designed permanent magnet circuit, is said to operate reliably and safely under all adverse conditions encountered in space flight or underwater operations and in explosive or corrosive areas.

The switch works like this: the magnetic flux is "piped" through a solid metal barrier into a sealed chamber containing the make and break electrical contacts where it is converted into a snap action to open or close the electrical contacts. There are no openings, mechanical pathways or springs.

The switches are available in three models designed to operate in temperatures of –65 to +900 F, in or out of water. They measure ¾ in. OD by ⅝ in. long and have a capacity of 0 to 15 amps, 125-v ac.

Space Components, Inc, 1048 Potomac St, NW, Washington, DC

MORE DATA? Circle 82, inside back cover



Flexible Shaft Handpiece Speeds Difficult Finishing Jobs

No. 55 angle-type handpiece resembles a dentist's drill and is designed for reaching difficult and otherwise inaccessible spots. It measures 6¼ x ⅝ in., weighs 4 oz.

Unit has a latch-design toolholder and hardened steel gears, and can be attached to any Foredom flexible shaft machine. Equipped with two mandrels, it can be used with standard unmounted accessories and very small dental-type burs, drills, or abrasive points. It can be used without modification for deburring, grinding, polishing, and similar applications.

Foredom Electric Co, Bethel, Conn

MORE DATA? Circle 83, inside back cover

Tumbling Media Shapes Include Round and Triangular Pins

Bonded shapes for abrasive tumbling now include round and triangular pins specially designed for barrel finishing intricate parts. Round pin abrasive is suited for finishing parts with round holes or grooves on the circumference. Triangular pin abrasive is suited for slotted parts because the 60° edge angle gets into the inside right angle

JONES & LAMSON MACHINE TOOLS

the man who needs a new machine tool is already paying for it

NOW J&L CAN PUT A NEW $20,000 MACHINE TOOL ON YOUR PAYROLL FOR $2.50 PER HOUR

...with no capital outlay

...no purchase option or obligation

...and payable entirely out of "Profitivity"®!

The announcement of J & L's revolutionary Profitivity Leasing Plan made national news in February, and resulted in the leasing by industry of a substantial amount of new high-speed, high-profit J & L equipment within the first thirty days.

If your production requires metal-working processes, don't fail to investigate the PROFITIVITY LEASING PLAN®. It is the most important machine replacement development in our history as a top producer of machine tools. Send for our new lease folder. Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

corners which square or round edges of other media cannot touch.

Round pins are available in diameters of 3/16 and ⅜ in., ⅝ in. long. Triangular pins are an inch long and ⅜ in. on the sides. They can be used on ferrous and nonferrous metals, plastic and rubber parts to remove burrs, heat-treat scale, refine surfaces and form radii.

Norton Co, Worcester 6, Mass

MORE DATA? Circle 84, inside back cover

New Motor Load Indicator Line Available From General Electric

Ac models are supplied as either ammeters, which measure percent of motor load current, or wattmeters measuring percent of horsepower. The dc instrument, an ammeter design, measures dc motor input current. Ac instruments are available for single and three-phase 50 or 60-c motors. A single ac instrument may be used with many different sized motors by employing a GE window-type JCH-O current transformer. Two standard scales, calibrated from 0 to 150%, can be supplied. Three instrument sizes are included: a 3½-in. panel meter (2% accuracy) and 4¼ and 8¾-in. switchboard instruments (1% accuracy). Respective scale lengths are 3, 7, and 14 in.

General Electric Co, Schenectady 5, NY

MORE DATA? Circle 85, inside back cover

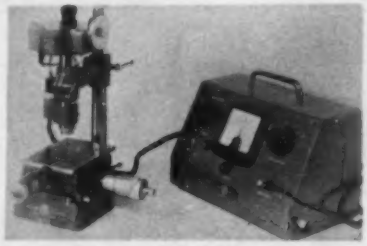


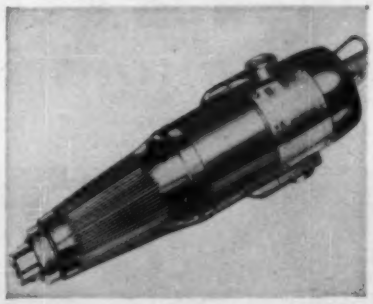
Photo-Electric Microscope Checks Precision Scales

Microptic microscope incorporates a photo-electric detector in its standard micrometer visual-setting eyepiece. This photo-cell detector registers a null reading on the electronic read-out meter when the scale graduation is truly central in the field of the calibrated slit. The microscope is housed in a tube of 7½-in. length and 1-in. dia and provides a measuring range of 0.05 in. total.

Instrument can be provided with a light source to illuminate the scale and can then be used to read graduations from 0.0001 to 0.0015 in. in width on any precision scale. Unit is so sensitive that relatively few repeated observations are needed to achieve a given precision.

Engis Equipment Co, 431 S Dearborn St, Chicago 5, Ill

MORE DATA? Circle 86, inside back cover



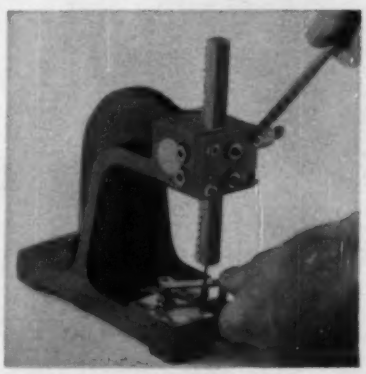
Hand Grinder Can Be Used With Carbide Burrs, Mounted Wheels

Series 40 hand grinders are rated at ¼-hp continuous duty and have a 35,000-rpm no-load speed. They are 10 in. long, weigh 3¾ lbs and take ¼ and ⅛-in. collets.

Features include higher load speed, flexible coupling to isolate the armature for cutting shocks, sealed-for-life bearings, metal seals and dynamic balancing of all parts.

Dumore Co, 1300 17th St, Racine, Wis

MORE DATA? Circle 88, inside back cover



Miniature Arbor Press Said To Be Smallest on Market

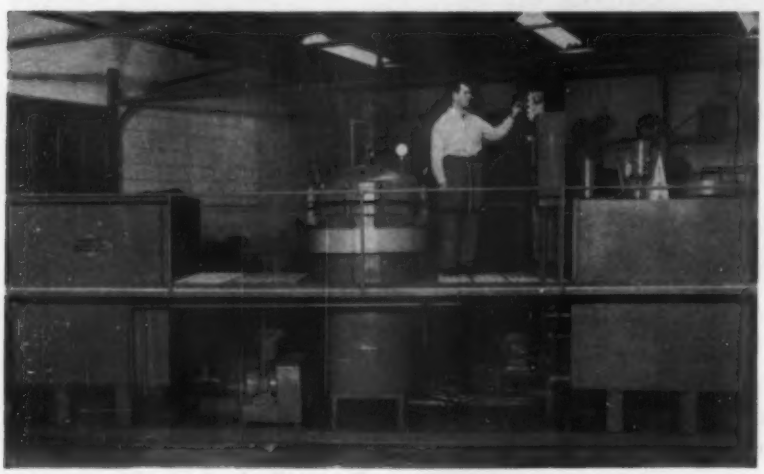
Micro-Press M-100 miniature arbor press, claimed to be the smallest precision arbor press on the market, is designed for precision assembly and fabrication of instruments, small parts and electronic components.

Specifications include 2½-in. ram stroke, 2½ x 1½-in. working surface, 2½-in. throat opening, 800-lb working force. It weighs 5 lbs and costs $32.

The press can be tooled to perform shearing, cutting, dimpling, piercing, broaching, riveting, blanking, light upsetting, drawing, forming, friction pressing, positioning of miniature ball bearings and setting of jewels and dial pointers.

Dickinson and Associates, 940 Alma St, Glendale 2, Calif

MORE DATA? Circle 89, inside back cover



BATCH-TYPE CASTING IMPREGNATION MACHINE, with automatic cycle, is designed for metal oxide sealants. It consists of a 300-gal sealant supply tank, 225-gal autoclave and 300-gal rinsing tank—*Prenco Mfg Corp, 2605 W 14 Mile Road, Royal Oak, Mich*

MORE DATA? Circle 87, inside back cover

JONES & LAMSON OPTICAL COMPARATORS

the man who needs a new machine tool is already paying for it

Now... an Economy-size Optical Comparator with "Big Machine" Features

Here is a fine optical inspection and measuring instrument of brand-new design. It is the first small-screen comparator to offer such BIG performance. It is equally suitable for production-line operation or job-shop work, and is extremely flexible in application.

The J & L TC-10 is of precision machine tool construction. This provides a solid base for precise inspection and measurement.

Three different table styles are available, including a fixed table for straight comparison work, a plain table, and a measuring table which gives you 6 square inches of measuring area. All measurements are read directly to .0001", without computation.

Among other things, the TC-10 is adaptable for *reflection inspection*. Reflected images are extremely sharp—even at high magnifications.

Other "big machine" features include Angle Measuring; Quick-Change Lens Mount; Vertical Staging; Tracing Inspection. And there's a big bonus in the 5X, 2" aperture lens, which gives inspection capacity and accuracy hitherto unattainable on a machine of this size. Write for folder. Jones & Lamson Machine Company, 502 Clinton St., Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

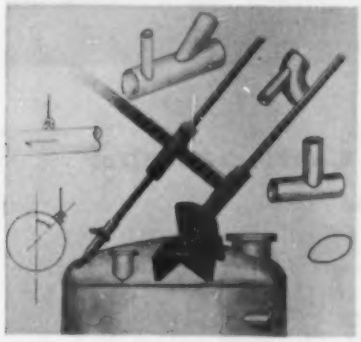
Mueller Mikrom Comparator Has Frictionless Amplification

Comparator has no gears, rack, pinions, or friction bearings; design eliminates friction, backlash, and lag, insuring perfect repeat readings. Amplification is mechanical.

Standard equipment carbide balls; backstop; lifting levers; and coarse, fine, and extra fine zero adjustments. Tolerance pointers are built into the measuring head. Removable platen table takes a 1½ x 3-in. hardened lapped platen that is ribbed on one side and flat on the other with provision to hold a backstop. Measuring heads have scale range from 0.006 to 0.0006 and graduations from 0.0001 to 0.00001 in.

Mueller Gages Co, 1052–1058 N Allen Ave, Pasadena, Calif

MORE DATA? Circle 90, inside back cover

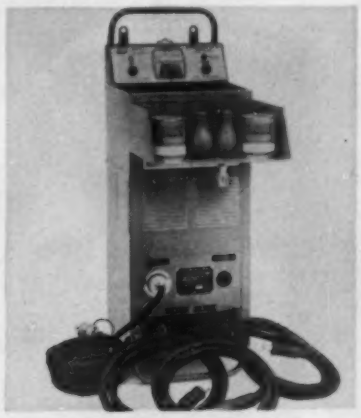


Pipe-Marking Device Eliminates Need For Templet Drawings

Sury Pipe Marker quickly and accurately draws projections directly at any angle on any working surface without use of projection drawings or layout work. It scribes ellipses ranging from 2½ to 3-in. min dia to 12 to 16-in. max dia, depending on angle desired. Lateral and header markings for angles from 0 to 45° are easily made. Marker operates on flat or multiple curved surfaces. Unit is equipped with a soapstone tip for metal surfaces; tip can be replaced with a ¼-in. pencil for use on nonmetal materials.

Sury Products Co, 3885 E 78th St, Cleveland 5, Ohio

MORE DATA? Circle 91, inside back cover



Portable Sonoflux Unit Offered For Magnetic Particle Inspection

Sonoflux Model AH-7 operates on 115 v ac, has both ac and half-wave dc outputs. Rated at 700-amp output, the 120-lb machine is 13 x 13 x 38 in. high and has an 11 x 12 x 9-in. high storage compartment.

It is used to find cracks or flaws in welds and castings and for maintenance inspection on all types of metal. It can be used with either wet or dry method with cables, contact prods, or contact clamps, and may also be used for limited demagnetization.

Peterson Machine Tool Inc, Sonoflux Div, Merriam, Kans

MORE DATA? Circle 92, inside back cover

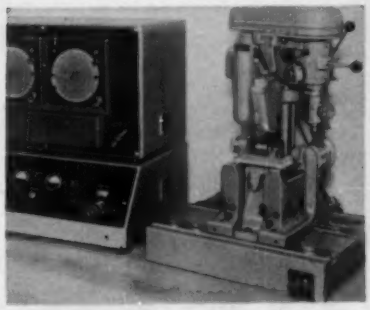
Line of AC Brake Motors Available In Sizes From ¼ Through ¾ hp

Form G fractional horsepower, 3-phase, ac motors in dripproof and totally enclosed, fan-cooled construction feature unified design which makes the motor and brake an integral, one-piece unit. Endshield of the motor also serves as endshield of the brake. They are designed for applications where positive stopping or holding of loads is required.

Magnetic brake is used to bring motor to rest and to hold load stationary when motor is not energized. It will automatically set in event of power failure. Brake torque is 3 lb-ft continuous. Quick, easy connection of the motors is provided by a large conduit box mounted on the right side facing the opposite shaft end. Ten-year lubrication without maintenance for normal service is provided. All models are rated 208-220/440, 550 v, 1725/1425 rpm. The ½-hp model is also available in 1140/950 rpm. Dripproof unit is rated 60/50 c, 40/50 C rise; totally enclosed fan-cooled model is rated 55 C rise.

General Electric Co, Schenectady 5, NY

MORE DATA? Circle 93, inside back cover



Schenck Balancers Designed For Small Part Applications

Schenck Models R06 and R16, made in Germany, are dynamic balancing machines for small parts such as gyroscope rotors and assemblies, fractional motors and turbochargers.

These bench-type units accept workpieces which may be belt, air, electrically driven or self powered. Rotor weight ranges are either 0.03 to 6 lbs (R06) or 0.1 to 20 lbs (R16). Rotating speeds may be from 1500 to 30,000 rpm.

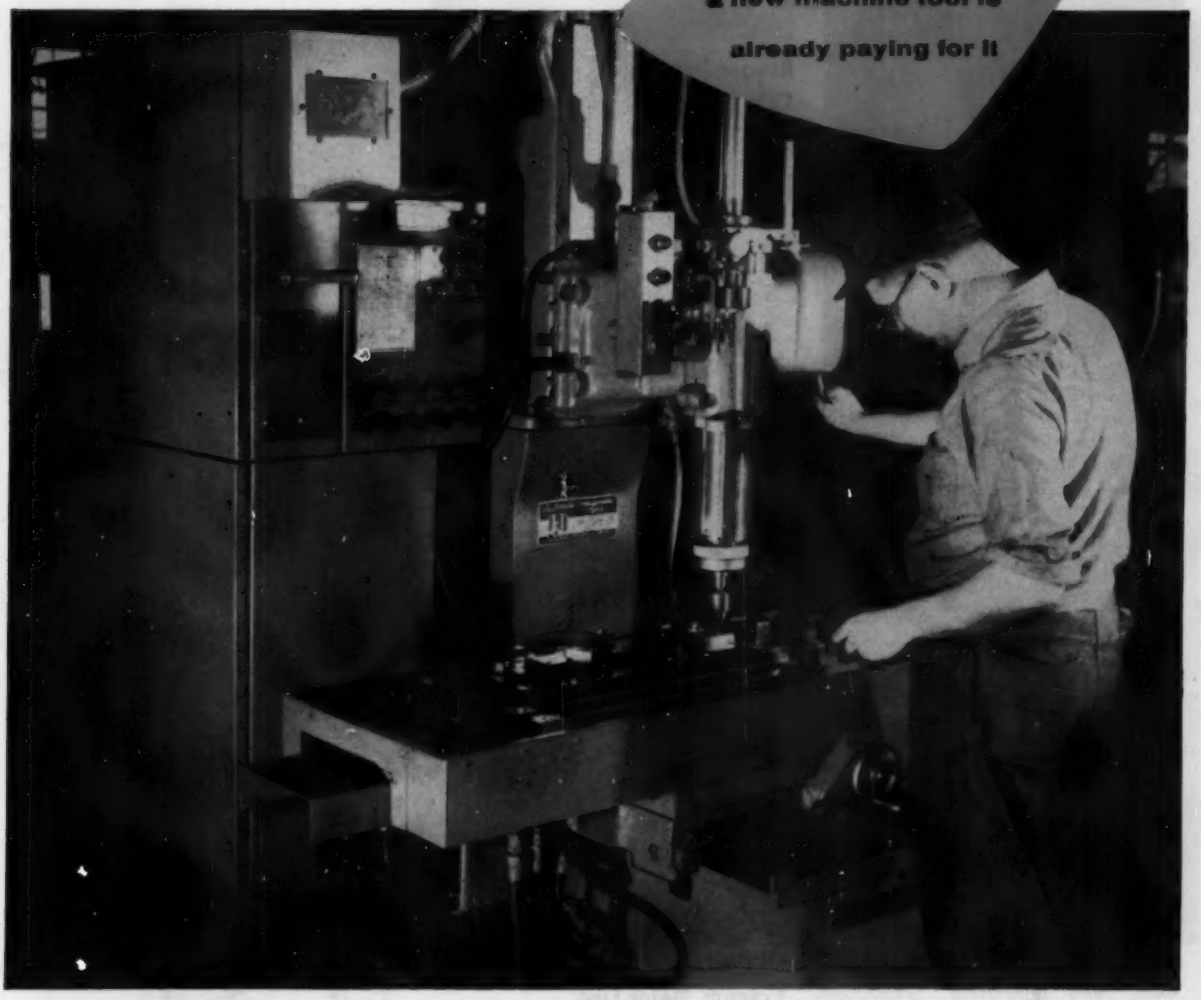
The unit checks unbalances creating work support movements as small as one-half millionth of an inch. A Wattmeter system indicates out-of-balance conditions simultaneously in two planes. On two calibrated circular screens light spots move from the screen centers in proportion to the amount of unbalances. The direction of the movement indicates the angular location of unbalances.

Dist by Cosa Corp, 405 Lexington Ave, NY 17, NY

MORE DATA? Circle 94, inside back cover

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it



Major savings on every job during first full year of tape control operation

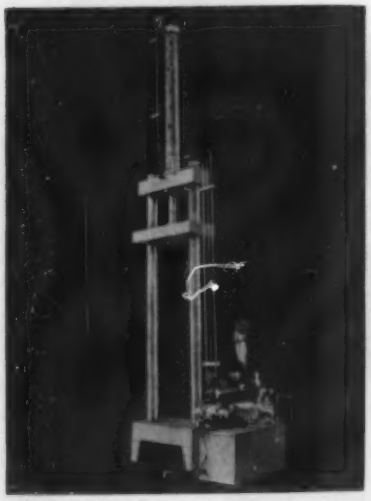
At The Goss Company, a division of Miehle-Goss-Dexter, Inc., Chicago, tape control machining plays an important part in the over-all production operation.

For instance, this J & L tape-controlled positioning table, equipped with a standard column drill press, has achieved an average of 30 to 40% savings in floor-to-floor time on every job assigned. One job, involving drilling and reaming of small malleable iron transfer roll adjusting plates, was transferred from a conventional sensitive drill press setup to the J & L machine. Job lots consisted of only four pieces.

The old setup required 3.1 hours production time for each lot. Using tape control, with a simple locating and clamping setup, Goss has been able to cut this time to 1.7 hours—a saving of 1.4 hours per lot, or more than 45%. Hole location is more accurate too, because J & L tape control consistently holds tolerances of + or — .001". With the old setup, it was difficult to hold hole locations to less than .010" on layout jobs of this size.

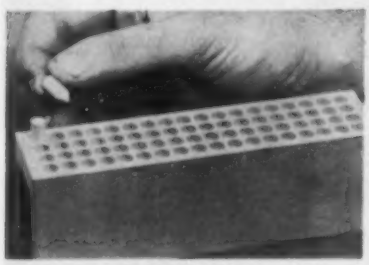
Investigate how *production-proven* tape control units can help increase the efficiency of *your* operation. Write to Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont for folder 5902, "Tape Control Positioning".

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



HYDRAULIC PRESS costs under $10,000, stands 19 ft high, has 108 in. of daylight and 24 in. between columns. It has a 78-in., 50-ton stroke—*Crossley Machine Co, Mammoth and Bell Sts, Trenton, NJ*

MORE DATA? Circle 95, inside back cover



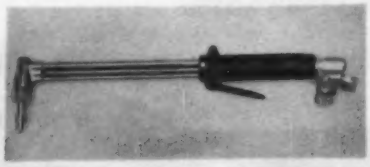
Ceramic Tooling Applicable To Precision Soldering

Tooling made from Duramic M120F-T can be used in soldering a range of components such as diodes, rectifiers, and electrical connectors. With heat resistance to 2012 F, the material will not oxidize or spall in the soldering range, and it is not wet by molten solder alloys. Its very low thermal expansion rate permits assembly tolerances held to micro-thousandths over thousands of cycles. Hardness is comparable to tool steel.

Product can be used in soldering operations in any heating method such as irons, flame setups, radiant heat, or induction soldering. It is manufactured to print in a wide variety of sizes from 10 x 10-in. boats to tiny inserts 0.062 in. in diameter. Tolerances as close as ± 0.0001 in. can be held if required.

Duramic Products Inc, 426 Commercial Ave, Palisades Park, NJ

MORE DATA? Circle 96, inside back cover



Rugged Duty Torch Cuts 24-in. Steel

Cutting torch, tradenamed Tuf-Tony, is primarily designed for heavy cutting under all conditions but adapts to a variety of less demanding applications by use of different Slip-in tips. Ease-on oxygen control valve permits gradual introduction of cutting oxygen. This reduces slag spray and facilitates control in such processes are piercing, rivet washing, and heavy cutting.

Torch is equipped with an over-or-under cutting lever which is easily reversed for operator preference. Large gas tubes and a high pressure valve port permit flow of the volume of gas required for heavy cutting. The 3-lb 10-oz unit is available in lengths of 21 and 36 in. with heads of 75 and 90°.

Smith Welding Equipment Corp, 2633 Fourth St SE, Minneapolis 14, Minn

MORE DATA? Circle 97, inside back cover

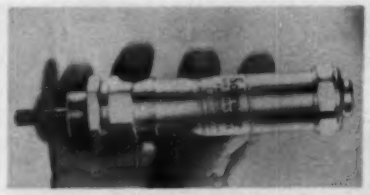
Lincoln Electric Redesigns, Expands Motor Line

Line of 3-phase squirrel-cage induction motors has been expanded to include sizes from ½ to 125 hp. "Multiguard" protection, a specially compounded thermosetting plastic used to encapsulate and impregnate the stator, is included on all sizes.

Die-cast aluminum rotor is supported by doubly shielded Super Conrad bearings. Bearings and fabricated steel end bell design permit operating the motor with shaft in either horizontal or vertical position. Bearing life is increased with a sealed housing that has a reservoir for grease storage and facilities for regreasing. Positive housing seal preventing entry of contaminants is achieved by mounting a neoprene slinger on the shaft against the exterior side of the end bell and fastening specially designed dust caps to the inner face of the housing.

Lincoln Electric Co, Cleveland 17, Ohio

MORE DATA? Circle 98, inside back cover



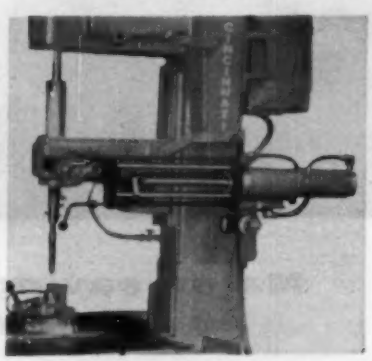
Midget Air Cylinders Suited For Pressures up to 125 psig

Series of double-acting units with 1-in. bores are available in six models with stroke size of 1, 2, 3, 6, 9, and 12 in. Overall length of the smallest (1-in. stroke) is 4-19/32 in.; largest (12-in. stroke) measures 15-19/32 in. long. Dimensions include a 1-in. threaded section of the piston rod.

These cylinders are designed for a range of light-duty and gang-type applications such as operating jigs and fixtures, or transfer and special purpose machines. They can be neck, angle-leg, or clevis-bolt mounted and can be actuated by hand, foot, pilot, cam, roller trip, or solenoid devices.

A Schrader's Son, Div of Scovill Mfg Co, 470 Vanderbilt Ave, Brooklyn, NY

MORE DATA? Circle 99, inside back cover



Air Powered Drillpress Feeds Available With Geared Head

Geared head models of air powered drillpress feeds provide either a greater drill point thrust with shorter stroke or a longer stroke at reduced thrust. Mounted on a 1-in. drilling machine, the unit makes possible a 2-in. stroke at 2500 lbs thrust or an 8-in. stroke at 625 lbs thrust, on a 1¼-in. pinion shaft at 100 psi air pressure.

Beckett-Harcum Co, Wilmington, Ohio

More Data? Circle 100, inside back cover

JONES & LAMSON MACHINE COMPANY

the man who needs a new machine tool is already paying for it

Two-dimension tracing eliminates secondary operations and reduces costly "off" machine time

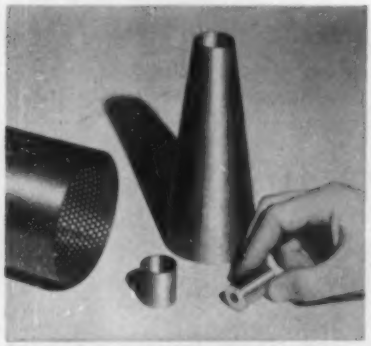
Two-dimension tracing, combined with conventional turret lathe tooling, provides an extremely versatile method for complete machining to tight specifications.

For instance, the end use of the connecting rod bolt (illustrated above) demands extremely fine finish to eliminate the starting of fatigue cracks. In addition, relief surfaces, O.D., head faces, and threaded end must all be square and concentric. Radii of fillets connecting the different diameters must be smooth and free from scratches. Two reliefs, each 6½" in length, must be held to + or — .002" and to 40-50 RMS to eliminate subsequent grinding operations. The finished parts are 19-3/4" long with different O.D.'s varying from 1-1/2" to 2-7/16". The material is tough: AISI 4140; Brinell 241.

All this is accomplished in one tooling set-up on a J&L turret lathe with a two-dimensional tracer. Floor-to-floor time for finished parts is less than three minutes on the head end, and less than nine minutes on the shank end. Write for Folder #5903.

Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



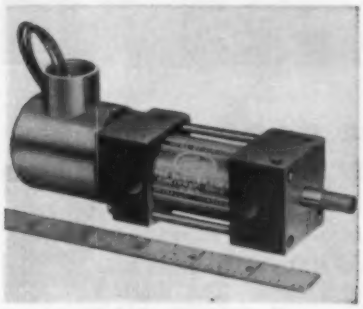
Lowcost Porous Metal Has High Strength, Accurate Pore Size

Lowcost wound wire porous metal, called Porostrand, is said to offer high strength, accurate pore size and wide size range. It is produced as cylinders, cones and various geometrical figures of revolution. Pore size ratings are 10 and 20 microns nominal and 25 and 50 microns absolute.

Porostrand is made by winding stranded and solid wires, made of almost any metal that can be drawn, side by side and layer on layer. Furnaces sinter the wires together at all contact points. Cylinders of this rigid material have high axial compression strength, burst strength and modulus of elasticity. Porostrand can be stamped, punched, ground or welded.

Bendix Filter Div, Bendix Aviation Corp, 434 W 12 Mile Rd, Madison Heights, Mich

MORE DATA? Circle 101, inside back cover



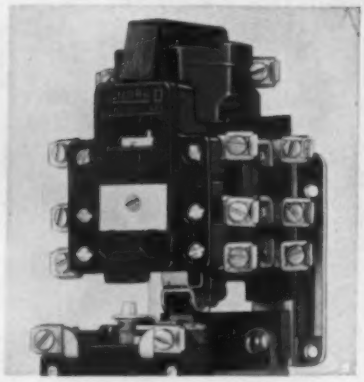
Automatic Cylinder Is Lightweight, Compact

Solenoid-operated cylinder for tooling and automation use has a 1⅛-in. bore and a 150 psi air, 250 psi water capacity. The clamp type unit is available in 1, 2 and 3 in. strokes from stock.

It is designed for 115-v 60-c continuous duty operation on temperatures up to 180 F with 10-w power consumption. Other strokes and voltages can be supplied on special order. The cylinder is 1½-in. sq and solenoid housing measures 1⅝ in. dia by 2 3/16 long. Weight of a 1-in. stroke unit is 21 oz.

Sheffer Corp, 326 W Wyoming Ave, Cincinnati 1, Ohio

MORE DATA? Circle 102, inside back cover



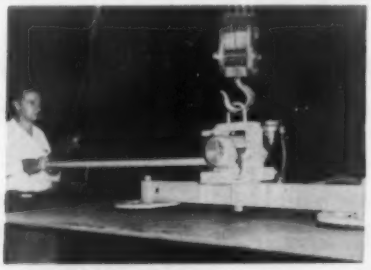
Time Delay Relay Combined With Machine Tool Relay

Device which combines the functions of a machine tool relay with a time delay relay reduces panel mounting space and installation time required by separate relays.

The timer head provides time delay either after energization or de-energization. Timing range is 0.2 seconds to 1 minute, ± 15%. The relay is available with 2 NO and 2 NC or 4 NO and 4 NC instantaneous contacts, plus 1 NO and 1 NC timed contacts. Relay contacts are rated at 10 amps.

Square D Co, 4041 N Richards St, Milwaukee 12, Wis

MORE DATA? Circle 103, inside back cover



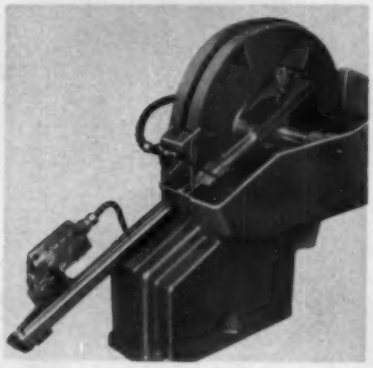
Two-Pad Beam Pad-Pac Handles Variety of Materials

Unit which requires only one man for operation will handle steel drums, stone, slab, concrete, sheet and plate steel, as well as many other nonporous materials. Standard model is equipped with two 16-in. pads and neoprene seal rings on a 48-in.-long I-beam. Lifting capacity is 2400 lb in horizontal, 1200 in shear position. Pads have a two-position (fixed) adjustment. Photo shows pads in outer adjustment on beam.

Self-contained unit is operated by a 1/3-hp Powerpac attached directly to the beam and consists of an electric motor, vacuum pump, filters, muffler, gage, check valves, and 3-way operated controls. Vacuum release is operated by push-button on control bar.

Vac-U-Lift Co, Division of Siegler Corp, Salem, Ill

MORE DATA? Circle 104, inside back cover



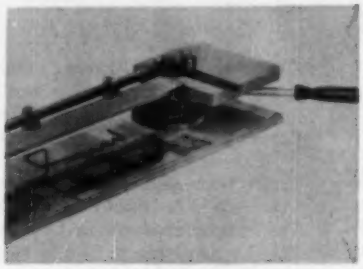
Parts Feeder Handles Up To 200 Parts per Minute

Parts feeder, Model FE-103, handles up to 200 parts per minute, has a motor-driven drum, variable-speed control and can be used in either dial-index or straight-line transfer applications.

Drum cleats for delivering the parts to the track are made of spring steel and molded rubber to prevent damage to the parts. Parts up to 1½ in. dia or lengths up to 3 in. can be handled. Bowl has a capacity of 700 cu in.

Dixon Automatic Tool, Inc, 2300 23rd Ave, Rockford, Ill

MORE DATA? Circle 105, inside back cover



HAND-OPERATED BENDER with 270° rotation can bend ⅜-in. square, round or V-shapes steel in less than one second—*W V Industries, Box 222, Hawthorne, NJ*

MORE DATA? Circle 106, inside back cover

General Mills said it about the Lindner Optical Jig Borer

"Machine time on the Lindner was 32 hours. Estimated time on any other machine or combination of machines in the shop was at least 64 hours, with serious doubts that the quality would have been as good."

The Job:

Machining an optical test fixture for checking the hemisphere sight for the MD-9 Tail Defense System, used in the B-52 Bomber.

The Specs:

1) Locating and boring bearing holes to +.0002, −.0000; 2) Locating and boring 49 additional holes for mounting optical lenses; 3) Milling a flat surface with first class microfinish around each hole to an angular position within ±2 minutes.

The Machine:

Lindner Optical Jig Borer, Model LB15A, with preselective Autopositioner®, used throughout for all locating and machining.

need we say more?

Learn why Lindner Optical Jig Borers have changed so many ideas about jig boring. Send for a 25-minute movie film demonstration without obligation.

Lindner Optical Jig Borers are available in two models: LB15A with Autopositioner—Table size 44" x 24"; LB14—32" x 16" (without Autopositioner)

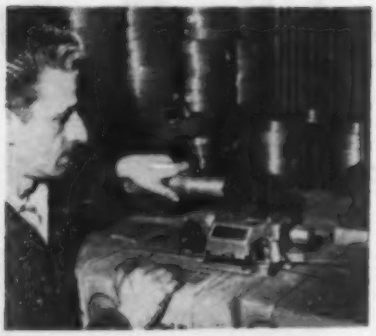
KO CO., INC. PRECISION MACHINERY

KURT ORBAN

COMPANY, INC.

36 Exchange Place, Jersey City 2, N. J.

CIRCLE 239 READER SERVICE CARD

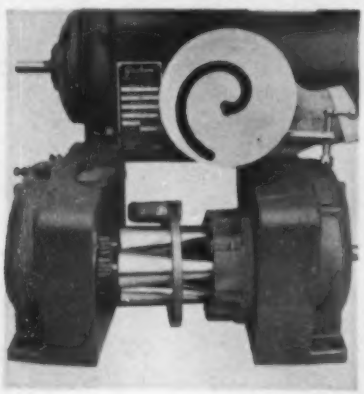


Pneumatic Steel Strapping Machine Secures Package in Three Seconds

Air-powered USS Model 13 tensions, ties and cuts round steel strapping in a 3-sec operation. Unit weighs less than 20 lb. After threading the machine and draping the package, operator simply turns a single control to complete the job. Handling the machine in production packaging can be facilitated through use of suspension hooks and balancers.

US Steel Corp, 120 Montgomery St, San Francisco 6, Calif

MORE DATA? Circle 123, inside back cover



Transmission Control Provides Directly Proportional Speeds

Cam control which provides changes in speed directly proportional to control adjustment is available for all Graham infinitely variable speed transmissions. It can be used for precise feed or automatic speed control systems.

A roller carrier fixed to the motor shaft supports three tapered rollers which are engaged by an encircling traction ring. Pinions fixed to the large end of the rollers engage a ring gear joined to the output shaft. To change speed, the traction ring is moved along the length of the transmission, engaging the rollers at varying diameters. The cam produces equal speed changes for each increment of movement of the micrometer control handle.

Graham Transmissions, Inc, Menomonee Falls, Wis

MORE DATA? Circle 124, inside back cover

Stock Reel Handles Coils Up to Six Inches Wide

The natural spring of the uncoiling stock rotates the ball-bearing mounted platen of this stock reel which takes material up to 6 in. wide in any thickness that can be coiled. The reel features a movable stock bar attached to the guiding mechanism for better initial control. It is available in 18, 24, 30, 36 and 40-in. sizes.

Durant Tool Co, 15 Thurbers Ave, Providence 5, RI

MORE DATA? Circle 125, inside back cover

Concentricity Measuring Gage Speeds Inspection Operations

New inspection tool called Centric measures to 0.001 in. tir 1 in. from spindle using present 5C collets, or to 0.0005 in. tir using selected collets for external holding. On internal holding of parts a tir of 0.0005 in. can be measured using Dunham expanding collets.

Gage which may be used for light cylindrical grinding on surface grinder, mounted on comparator for concentricity measurements, takes standard AGD indicators. Indicator bracket slides forward to measure long pieces and lifts to swing clear for easy chucking of parts.

Dunham Tool Co, New Fairfield, Conn

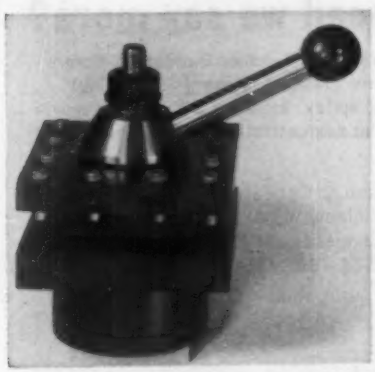
MORE DATA? Circle 126, inside back cover

Hobbs Hour Meters Offered For AC Equipment

New line of sealed meters indicates in hours and minutes the cumulative operating time, up to 100,000 hours, of any machine, tool, or equipment run with 120 to 480-v alternating current. Available in 2½ and 3½-in. diameters, the new ac meters are furnished in black Bakelite cases with 2.94-in. overall depth.

John W Hobbs Corp, Division of Stewart-Warner Corp, 1826 Diversey Pkwy, Chicago 14, Ill

MORE DATA? Circle 127, inside back cover

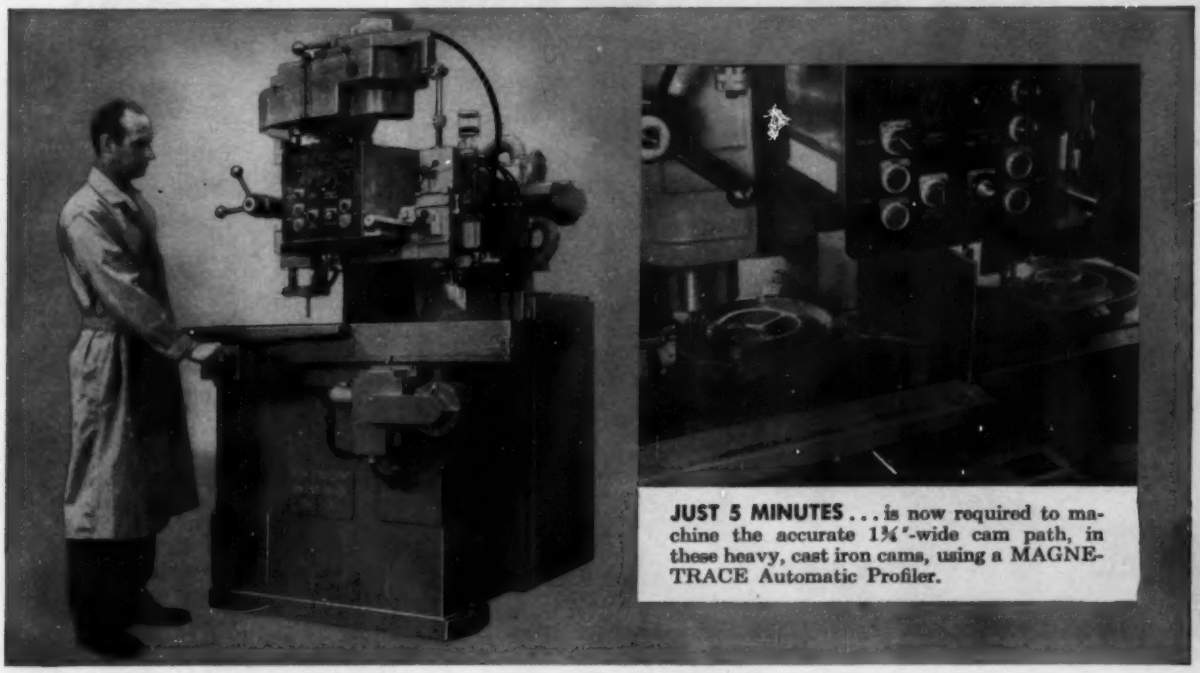


TURRET TOOL POST for lathes up to 16-in. swing has eight repeating positions and can be locked at any position. The 2½-in. size costs $24.95, the 4-in. size for $61.80—*Dayton Superior Products Co, 420 Stonemill Rd, Dayton, Ohio*

MORE DATA? Circle 128, inside back cover

ACCURACY ASSURED...

...and complex contours produced at PLAIN-MILLING SPEEDS and FEEDS with



JUST 5 MINUTES... is now required to machine the accurate 1¾"-wide cam path, in these heavy, cast iron cams, using a MAGNETRACE Automatic Profiler.

the All-New MagneTRACE TRADE MARK Automatic Profiler

Designed, developed and built from the base up *specifically* for 360° profile milling under tracer control, the MAGNETRACE is compact, rigidly constructed, and has a powerful 7-speed spindle drive for fast removal of heavy metal. This powerful drive – plus the fact that the tracer follows the easily prepared steel template at a constant, preset feed up to 80 inches-per-minute – makes it possible to mill complex, irregular contours as fast as conventional machines produce plain-milling cuts. Many jobs ordinarily requiring roughing and finishing cuts are completed in a single pass. Finer finishes are obtained, and cutter life is greatly increased!

In addition, the extreme sensitivity of the unique MAGNETRACE tracer system (which requires a stylus deflection of only .0002" to activate the drive units), the complete elimination of backlash in the slide motions, and the overall precision and rigidity make it possible for the MAGNETRACE to produce copy milling with an accuracy comparable to that of precision, plain milling operations.

FOR COMPLETE INFORMATION

...write now for your free copy of the new P&W 8-page Circular No. 635. See how the greatly increased speed and accuracy of the MAGNETRACE can be translated into actual dollars-and-cents savings in your shop. Pratt & Whitney Company, Incorporated, 11 Charter Oak Blvd., West Hartford, Conn.

100th Anniversary 1860 P&W 1960

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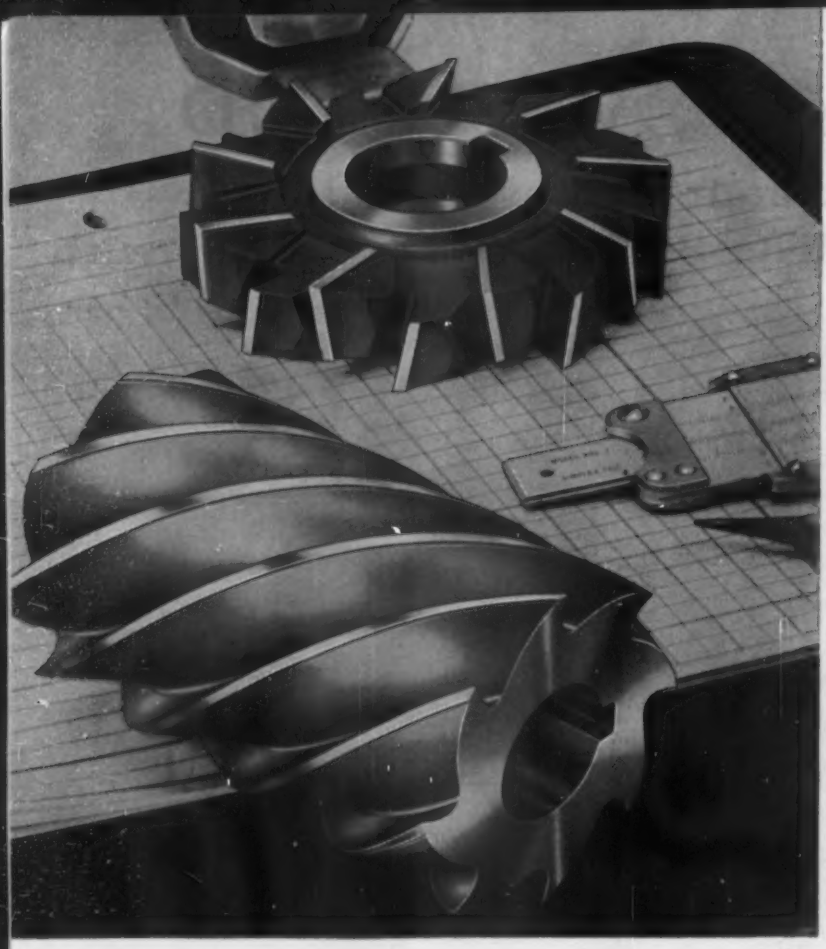
MACHINE TOOLS • GAGES • CUTTING TOOLS



BUY SHARPER... NOT CHEAPER

In the long run, Pratt & Whitney Cutting Tools will cost you far less, because they're quality all the way. They produce far more pieces per tool and insure better, more accurate work. Don't forget, quality is long remembered, but price is soon forgotten.

Pratt & Whitney produces complete lines of standard and special cutting tools in high speed steel and solid carbide for every industrial requirement. And to provide the prompt delivery service you need, comprehensive stocks are carried on the shelf at the P&W Branch Office near you.

For complete cutting tool information and ordering data, write now to Pratt & Whitney Company, Inc., 11 Charter Oak Blvd., West Hartford, Conn.

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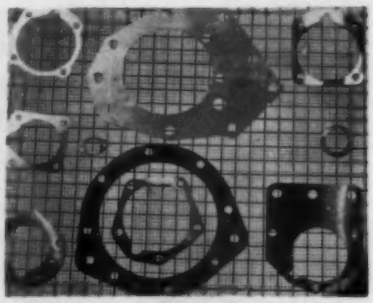
CIRCLE 241 READER SERVICE CARD

NEW SHOP EQUIPMENT

CORRECTION: The Quick Set Chuck described on page 178 of the April 4 issue can be adjusted to 0.0002 in. in 30 seconds, not 0.002 in. The chuck is manufactured by the Whiton Machine Co, New London, Conn



Custom-Made Machinery Shims Offered at Cost Saving

Company has developed a new method of producing various sizes of thin machinery shims of brass, steel, stainless, bronze, and any other sheet alloy. Tooling runs about 5% to 10% of that of conventional dies. Manufacturer claims that the smaller the piece, the less it costs to run.

Any size of shim from the smallest up to 12 x 12 can be produced at a die cost of about $20 to $40, depending upon the detail involved. Shim parts can be produced at a labor cost of about 0.01 to 0.25 each, depending upon size required. Process is particularly adapted to unusually thin shims starting from 0.001 to 0.010 in. thick.

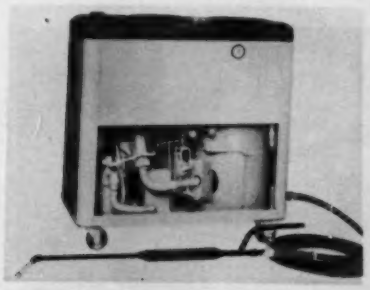
Dayton Rogers Mfg Co, 2824 13th Ave South, Minneapolis 7, Minn

MORE DATA? Circle 107, inside back cover

INSPECTION MAGNIFIER is self-illuminated with 7X lens and is equipped with a detachable base with a 1 x 1 in. opening ruled in both inches and millimeters. Price is $9.95—*Litho Research, Inc, 14339 36th Ave, NE, Seattle 55, Wash*

MORE DATA? Circle 108, inside back cover

NEW SHOP EQUIPMENT



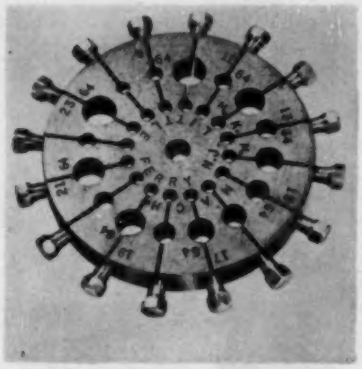
New Steam Cleaner Delivers 130 gal of Hot Solution Hourly

Model 130 delivers 10 gal more cleaning solution per hour than former sizes yet sells at the same price. Extra capacity, plus a newly designed orifice and nozzle, reportedly increases cleaning efficiency 20%.

The oil-fired, caster-mounted model shown measures 45 in. long, 21 in. wide, 43 in. high, and weighs 565 lb net. Price is $845. A gas-fired stationary model is also available.

Malsbary Mfg Co, 845 92nd Ave, Oakland 3, Calif

MORE DATA? Circle 109, inside back cover



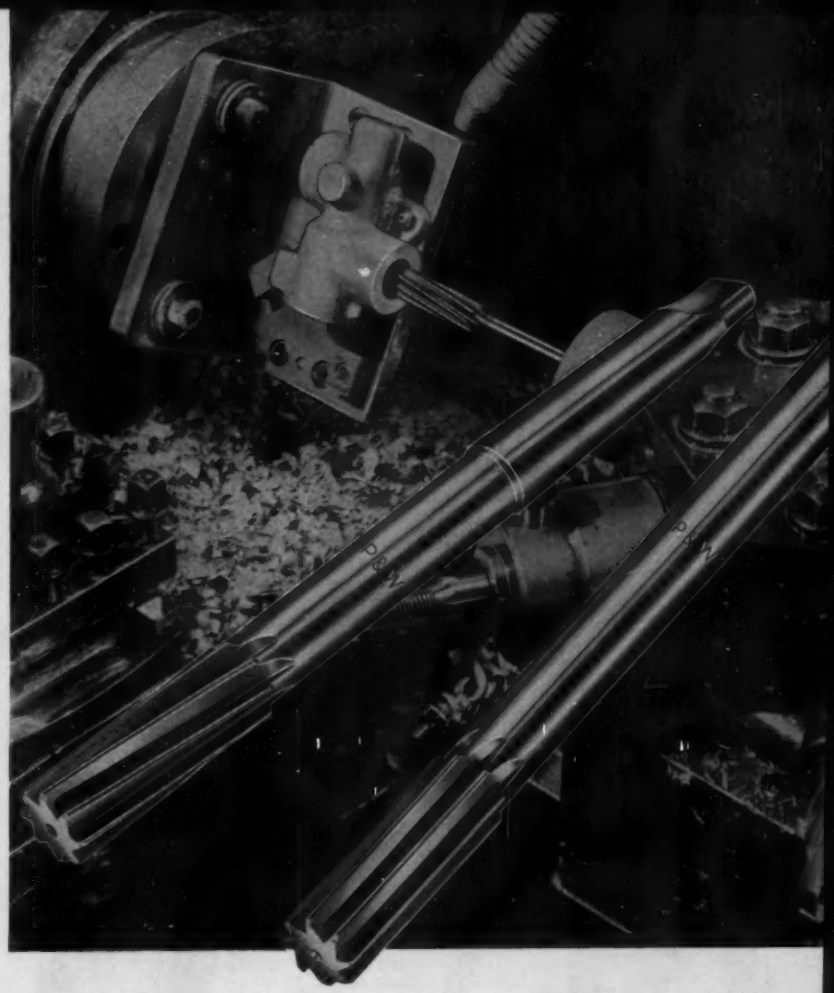
New Hunt Clusterlap Speeds Lapping of Oversize Reamers

Unit laps reamers to precision sizes without removing the tool from the machine setup. It provides for lapping reamers to off sizes with close tolerances to achieve perfect dimensions as specified. One lap handles 16 adjustable sizes. Range is from 1/32 to 1 in. in six different models.

Additional applications include lapping standard drills to off sizes, assuring that drilled holes can be held to exceptionally close tolerances; final sizing and super finishing of plug gages.

M K M Machine Co, 325 Main St, Little Ferry, NJ

MORE DATA? Circle 110, inside back cover



QUALITY COSTS LESS, BECAUSE IT PRODUCES MORE!

Pratt & Whitney Reamers stay on the job longer . . . produce more smooth, round, accurate holes per tool. Correctly designed, carefully manufactured from selected steels, expertly heat treated and given an exclusive surface treatment, they're *quality all the way.* Investing in the finest will save you *dollars* in the long run.

Pratt & Whitney produces reamers for every industrial application. You can select standard types and sizes from on-the-shelf stocks at the P&W Branch Office near you; non-standard sizes are quickly ground and delivered from stocks of hardened blanks. Write now for complete information. Pratt & Whitney Company, Inc., 11 Charter Oak Blvd., West Hartford, Conn.

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VALVOLINE
Tectyl
protects metals
against RUST

VALVOLINE'S amazing Tectyl rust preventives protect metal surfaces against *rust and corrosion* during storage and shipping.

Low-cost Tectyl compounds are easy to apply by brush, spray or dip and just as easy to remove. They protect metal surfaces against the effects of snow and rain... salt air, humidity, perspiration and corrosive fumes.

Tectyl rust preventives meet exacting government specifications.

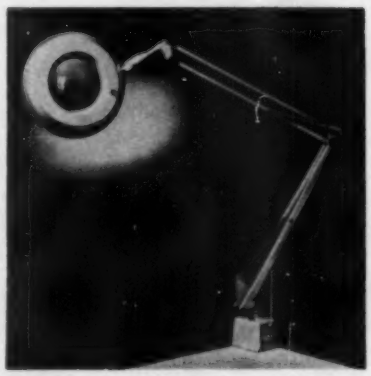
Write today for these two helpful Tectyl charts

1. "Valvoline Tectyl U. S. Government Approved Packaging and Preservative Chart." Gives the Army, Navy, Air Force and other Government Agencies' specifications and applications.

2. "Valvoline Tectyl Industrial Rust Preventive Comparison Chart." Specifies applications covering the industrial field.

VALVOLINE
Tectyl RUST PREVENTIVES

VALVOLINE OIL COMPANY, Freedom, Pennsylvania
A Subsidiary of Ashland Oil & Refining Company

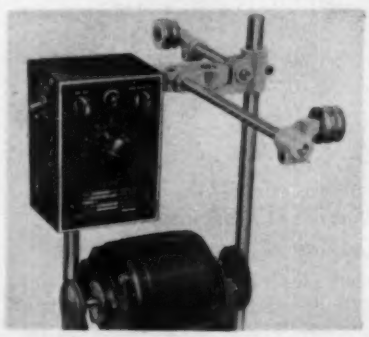


Magnifying Lamp Designed For Small Parts Inspection

Model M-1C combines a 22-w circlite lamp with a 5-in. magnifying lens. Both the light and magnifying lens are contained in the swivel shade with the light automatically directed onto the part being magnified. Entire head of the unit swivels 354° to permit easy adjustment to the proper working position. This adjustment provides glare-free lighting without distortion of the magnified image. Arms of the lamp are also fully adjustable; 45 in. long, they are counterbalanced to prevent slipping. They can be locked in position by thumbscrew adjustment. Model can be furnished with clamp, wall, or pedestal mount.

Swing-O-Lite Inc, Hackensack, NJ

MORE DATA? Circle 111, inside back cover



Variable Speed Motor Drive Offered for Jewelers' Lathes

Motor drive unit, containing no tubes, provides a continuously variable spindle speed from 0 to 4000 rpm. Foot-operated switch actuates, starts and stops and also operates a coolant pump when it is used. Features include dynamic braking; reversing switch and a separate switch for controlling the coolant pump are mounted on the control unit.

Unit operates on 110-v 60-c single-

CIRCLE 243 READER SERVICE CARD

CIRCLE 244 READER SERVICE CARD ►

A COMPLETE GEAR PROGRAM

TO ASSURE YOUR PRODUCT'S EFFICIENCY

Visit us at the Machine Tool Exposition, Booth No. 242

Whenever you have a gear problem—any gear problem—consult Illinois Tool Works for the right answer!

From transmissions to turbines—from radar antennas to atomic reactors—if your product requires gears or gear trains, Illinois Tool Works has the experience, skill and facilities to solve your gearing problems.

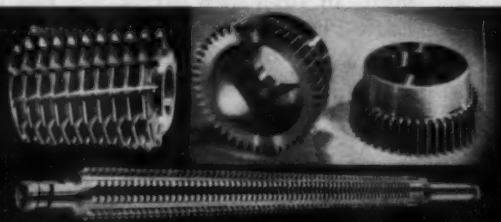
Gear users and gear producers are now offered valuable assistance in gear analysis, gear design, prototype and model manufacture, gear tooling and quality control. This complete program is available to help you improve product efficiency and economy to strengthen your competitive edge.

As a proven advisor to the Army, Navy and scores of power-product manufacturers, Illinois Tool has gained the background and engineering know-how to accurately analyze your gearing problem and to recommend the most satisfactory solution for your specific requirements. This service even includes training your personnel.

Write Today for your "Gear Technical File"

GEAR QUALITY CONTROL

Gear specialists at Illinois Tool have developed gear measuring instruments, ranging from simple hand rolling fixtures to fully automated final gear inspection machines. Among these are units capable of mechanically inspecting hundreds of gears per hour for all known elements and sorting them categorically. Whatever your quality control requirements let Illinois Tool recommend the system best suited to your needs.



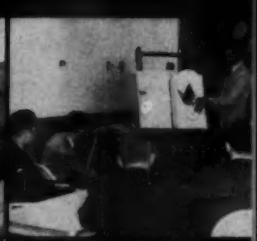
GEAR TOOLING

Illinois Tool Works hobs, shaper cutters, broaches and gear cutters are used to produce thousands of gears daily. They are specified by nearly every major gear producer in the country—proof of their quality, efficiency and economy.

INSPECTION

ANALYSIS AND DESIGN

PROTOTYPES



EMPLOYEE TRAINING

GEAR SERVICES

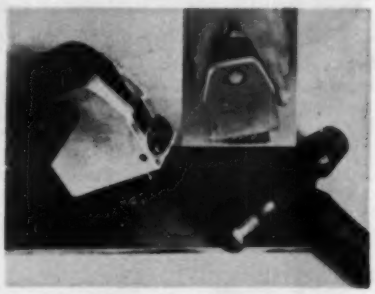
Illinois Tool Works maintains (a) a complete atmosphere-controlled laboratory fully equipped for analyzing and inspecting gears, gear trains or gear-like parts; (b) an engineering staff to design and or recommend gear drives; (c) development facilities to produce models and prototypes; (d) a process group to detail production and quality control procedures; (e) employee training for your personnel which includes a highly concentrated classroom-and-shop course in gear engineering, production and quality control.

ILLINOIS TOOL WORKS
TOOL & INSTRUMENT DIVISION
2501 North Keeler Avenue • Chicago 39, Illinois
In Canada: CITCO DIVISION, CANADA ILLINOIS TOOLS, Ltd., Don Mills, Ontario

phase ac and contains full overload protection. The ⅛-hp double-ended motor is mounted on a base provided with an adjustment for belt tension. Completely adjustable swiveling idler for driving accessories such as a grinding attachment, drilling or milling attachment, is included on Model ACAZ or may be added to Model ACAY.

Louis Levin & Son Inc, 3610 S Broadway, Los Angeles 7, Calif

MORE DATA? Circle 112, inside back cover



Steel Marking Die Holder Has Built-In Alignment

Flexaligner, a hammer-style holder for marking with steel character dies, is self-aligning, permitting the stamping of clear markings by compensating for slope or other irregularity of the marking surface, for tilted holder positioning, and for glancing of the striking hammer.

When holder is tilted, the pivoted anvil seeks its own alignment and maintains contact with the steel stamping type, transmitting full striking force imparted by the hammer. The heat-treated anvil is replaceable.

Pannier Corp, 104 Pannier Bldg, Pittsburgh 12, Pa

MORE DATA? Circle 113, inside back cover

"You say you 'had to talk with your family,' what's the matter, your T.V. busted?"

There's a BIG difference in floor absorbents

MAKE THIS DISCOVERY!

RIGHT IN YOUR OWN OFFICE you can test the difference of Eagle-Picher Industrial Floor-Dry with whatever oil absorbent you're now using. You'll discover it actually absorbs as much as 100% or more liquid per pound than other floor drying materials.

YOU'LL ALSO PROVE that Eagle-Picher Floor-Dry retains its skid-proof granular mineral form even when saturated. It doesn't mud or pack. Light in weight, it spreads easier and covers a larger area. Non-combustible, it has no chemical reaction. And possessing unusual reflective power, Floor-Dry makes working conditions bright and pleasant, as well as safe!

Since 1843 EAGLE EP PICHER

WRITE TODAY. Our Eagle-Picher representative will bring the portable laboratory to your office where you may make this test yourself. **The Eagle-Picher Company,** Dept. AM 516, Cincinnati 1, Ohio.

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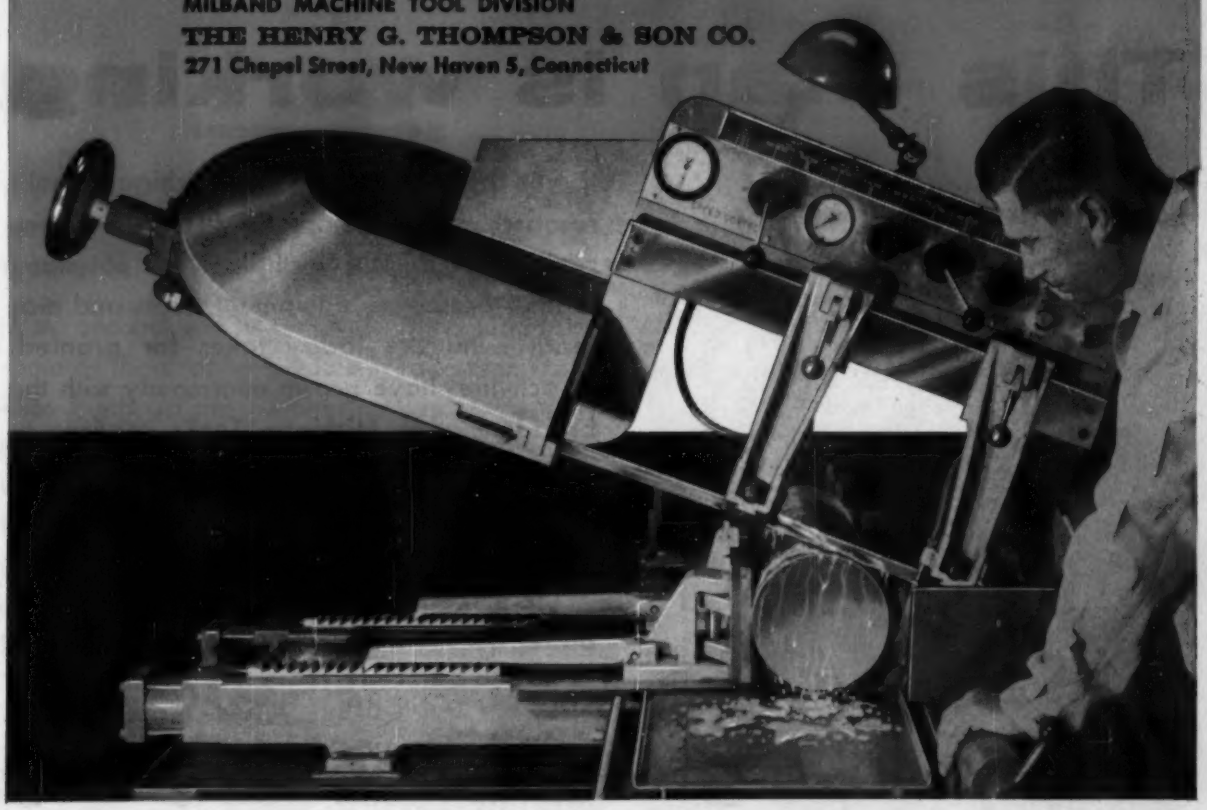
THAT YOU INVESTIGATE . . . AND WITNESS A DEMONSTRATION OF THE ALL-NEW

Milband

HORIZONTAL BAND SAW MACHINE

. . . a machine tool designed and built specifically for maximum efficiency and full blade life, using high speed steel band saw blades. Until you've actually seen this machine in action, you can't fully appreciate its ability to speed your cut-off production sawing and reduce your per-cut costs. Write for illustrated Milband fact folder. Ask for a demonstration.

MILBAND MACHINE TOOL DIVISION
THE HENRY G. THOMPSON & SON CO.
271 Chapel Street, New Haven 5, Connecticut



This man is working

If you have never visited Michigan Tool's research and development laboratory, you really should. The birthplace of so many ideas—processes, equipment, tools and materials—industry today takes for granted, its activities have grown enormously with the broadening of Michigan Tool's services to industry.

The lab has two purposes.

The first, to find the answers to your immediate questions—in every phase of gear

Michigan Tool Company

MTC Research Engineer using an angular interferometer to check an indexing table. Accuracies to a millionth of an inch at 1 inch radius are possible with this equipment. Interferometer room temperature is controlled to ¼° F.

for YOU

production, in automation, in generating of forms in hard materials, in producing prototype gearing, etc.

Its second job is to find the solution to some of the problems you will face tomorrow —to keep up the pioneering pace of engineering leadership that produced such innovations as gear shaving, Roto-Flo cold forming, Shear-Speed gear cutting, double-enveloping gearing, "Velvet-drop" feeders and other ideas for automation systems, Sine-Line optical checking, and many others.

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Gear Production: The most complete line of equipment for gear production offered by any manufacturer.

Hobbers and Shapers for Job Lots
High Production Hobbers
Shear-Speed Gear Shapers
Roto-Flo Cold Forming
Shavers for gears of ½" to 200"
Internal and External Form Grinders
Sine-Line Gear and Tool Checkers
Gear Chamfering Equipment
Abrasive Gear Finishers
Mitco Quality Gear Cutting Tools

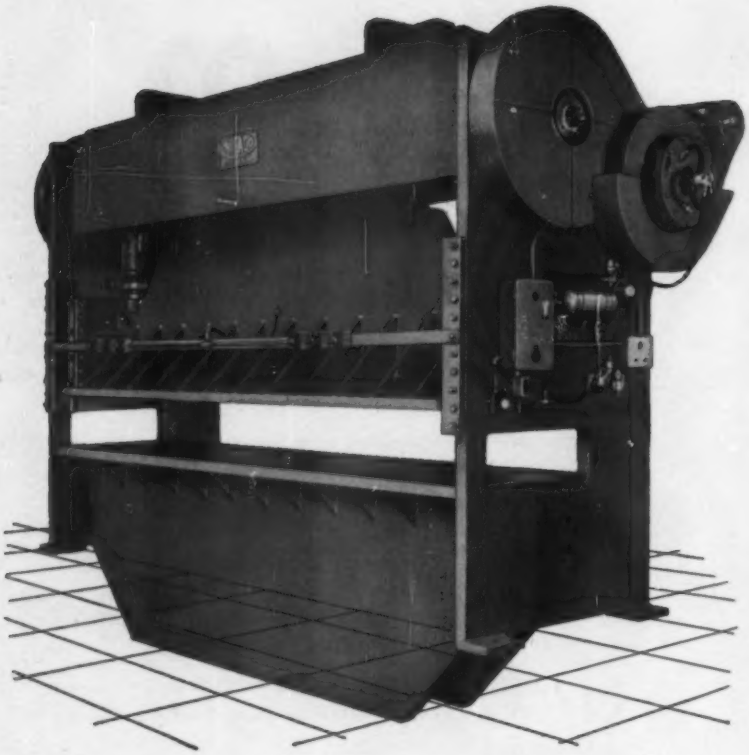
Automation Equipment (Gear-O-Mation Division): Engineering and manufacture of simple and practical equipment for automating a plant, a line, or a machine. Pre-engineered units for orienting, storage, loading, unloading, assembling, conveying, escapements, positioning, elevating, deeding.

Form Grinding (Gear Grinding Machines Division): "Detroit" fully automatic form grinders for both external and internal contours—involute, cycloidal, spherical, straight sided.

Prototype Gearing (Enterprise Division): Spur, helical, bevel gears and splines for prototypes and in developmental quantities. Also contour form grinding, internal and external.

OTHER MICHIGAN TOOL DIVISIONS INCLUDE:

Cone-Drive Gears Division (double-enveloping worm gears, speed reducers, gear motors); Michigan-Lorenz Division (hobbers and shapers); Shear-Speed Chemical Products Division (coolants and cutting oils); Colonial Tool Co. of Canada Ltd. (cutting tools of all types).



CHICAGO DREIS & KRUMP

PRESSES
STRAIGHT-SIDE TYPE

large die area
capacities up to 400 tons

This is a typical model of CHICAGO straight-side-type presses used for multiple punching, notching, and trimming operations. This press with a die area of 48 inches by 198 inches has a capacity of 200 tons.

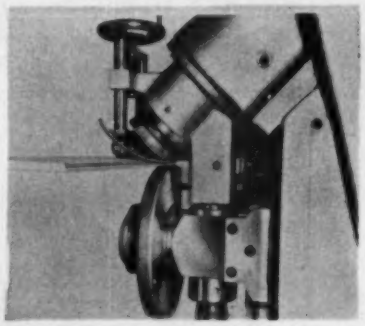
Complete recommendations for any job on request.

6874

CHICAGO DREIS & KRUMP

Press Brakes • Straight-Side-Type Presses • Press Brake Dies
Hand and Power Bending Brakes • Special Metal-Forming Machines

DREIS & KRUMP
MANUFACTURING CO.
7434 South Loomis Boulevard, Chicago 36, Illinois

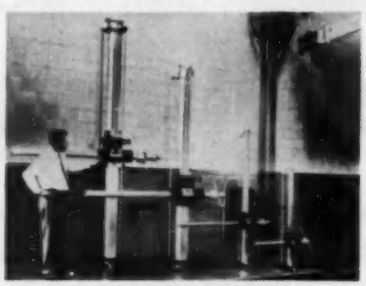


New Pullmax Beveller Cuts ½-in. Bevel on Mild Steel Plate

Model X-8 cuts ½-in. bevel (or ⅜ in. in stainless) to prepare the seam for a perfect arc weld fillet. On plate up to 1 in. thick, both sides can be bevelled by turning the plate. Machine is designed to provide fast easy bevelling on small, hand-carried pieces for weldments; many users bevel larger pieces, however, by using a support table around the front of the machine. Cutting speed with mild steel is approximately 11 fpm. Units are available in three models to cut 30, 37½, or 45° bevels.

American Pullmax Co, 2455 N Sheffield Ave, Chicago 14, Ill

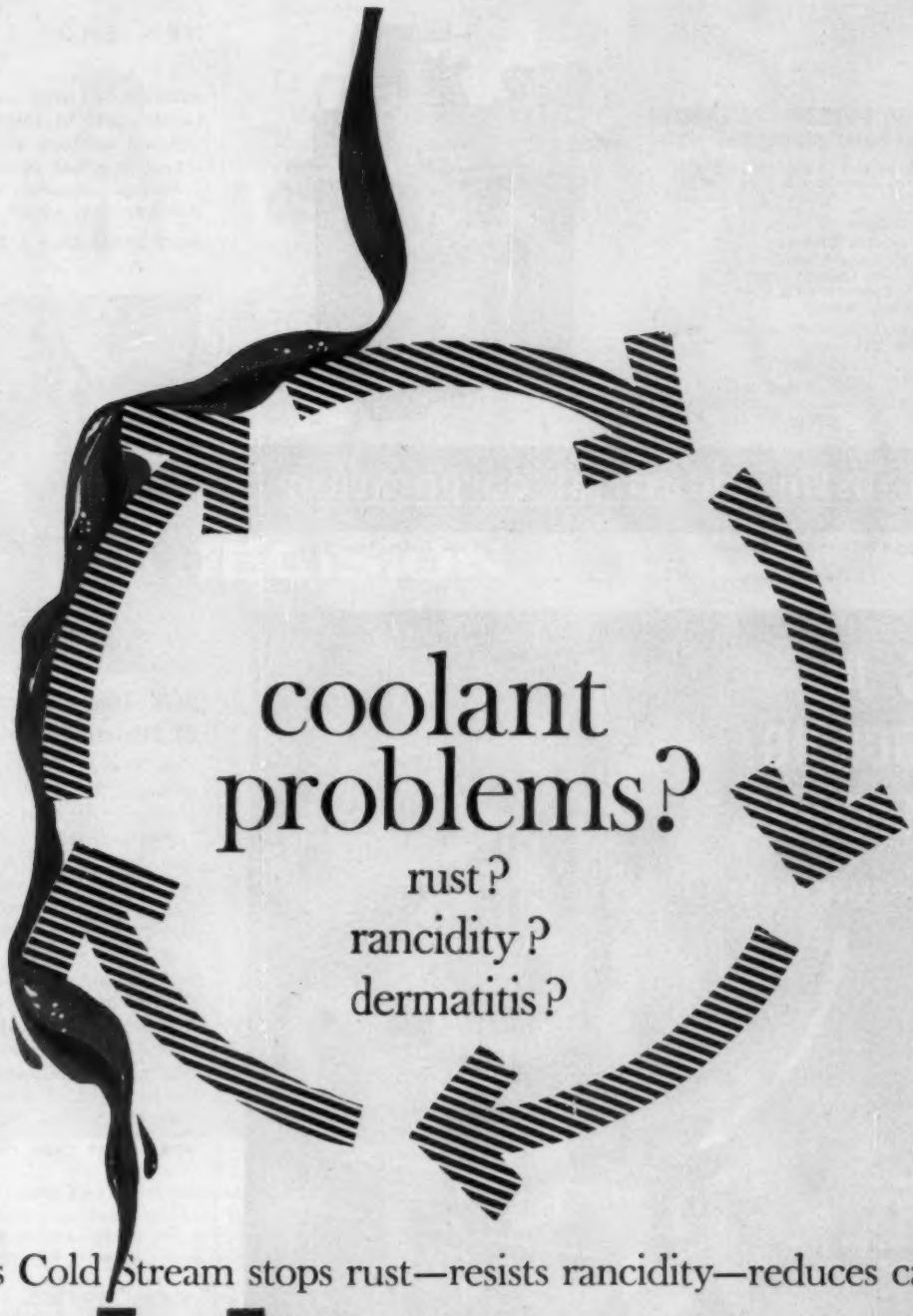
MORE DATA? Circle 114, inside back cover



New Layout Machines Added to PDQ Line

Layout work can now be done on 2, 4, 6, and 8-ft-high castings; horizontal reach is 18, 36, 48, and 48 in. respectively. Machines can quickly lay out vertical, horizontal, inside, or outside lines for final machining. Workpiece, in most cases, need not be clamped or moved once it is positioned; angle plates, protractors, and other hand tools are completely eliminated. It is reported that layout time work can be reduced as much as 80%.

Upright column, cross arm, and linear attachment are all equipped with vernier scales calibrated to 0.010 in. Vertical and horizontal distances from center lines can be established by simply adding or



coolant problems?

rust?
rancidity?
dermatitis?

Johnson's Cold Stream stops rust—resists rancidity—reduces causes of dermatitis. These problems start when your coolant gets dirty. Cold Stream stays clean weeks, sometimes months longer. Cold Stream gives longest tool life, finest finish, highest speeds and feeds. Best dimensional control. Cold Stream gives you all the performance you pay for. **JOHNSON'S WAX**

cold stream

For information, see your local Johnson industrial distributor.

"Cold Stream" and "Johnson's" are trademarks of S. C. Johnson & Son, Inc., Racine, Wis.

MSO GRINDERS - PACEMAKERS for better grinding methods—

The ultimate in precision grinding to close tolerances with micro inch finish — for Toolroom — for Production

MSO builds
- Universal Grinders
- Production Grinders with automatic plunge or traverse grinding cycles
- Thread Grinders

When only the best will do — check MSO first

Model FMES Universal Grinder with compound swivel wheelhead capacity 7" x 12"

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

MSO JIG BORING MACHINE

WITH LEITZ OPTICS

Table size — 33½" x 18½"
Spindle speeds — 63 — 2000 RPM
Boring depth — 12"
Net Weight — 7500 lbs.

MSO The ULTIMATE in

precision

Setting accuracy .00002". Positioning accuracy .00012".

speed

Select any point as starting point. "Zero-in" scales by push button. Read scales to millionths without leaving operator's position.

ease

Direct reading on magnified screens in any quadrant from zero point. Table moves on double roller guides.

When only the best will do — check MSO first.

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

subtracting from reference points. Guide slots in the table base provide an accurate guide for machine travel in either direction at 90°.

Portage Double Quick Inc, 1026 Sweitzer Ave, Akron 11, Ohio

MORE DATA? Circle 115, inside back cover

DoAll Offers Complete Line Of Miniature Cutting Tools

New line of miniature cutting tools includes twist drills, pivot drills, center drills, reamers and end mills.

Twist drills range from 0.15 to 0.5 mm in left and right-hand cut. Pivot drills with 1-mm shanks range from 0.1 to 0.4 mm. Center drills are standard in sizes 00 and 0.

Straight - shank, straight - fluted reamers are made in wire gage sizes 61 through 80 and 1/64 and 1/32 in. Tolerance is +0.0002, -0.0000.

End mills are standard in 11 styles and a size range from 1/32 to 3/16 in. by 64ths.

DoAll Co, Des Plaines, Ill

MORE DATA? Circle 116, inside back cover

"I sure put in a good day's work, but it took me a week to do it."

HOUR OF DECISION

After hours? — sure You're not surprised at that because you know it's when he (and probably you, too) concentrates on the problems which are vital to his company's continued successful growth. The day is filled with production crises, maintenance problems, personnel questions, and committee meetings. It's only now that he can really study the facts and decide what's best.

Right now he's reviewing his machine tool inventory. He's amazed at how old some of his equipment is getting to be. It seems only yesterday that he signed the purchase order for it to increase his capacity for World War II. But that was 1943, seventeen years ago! No wonder maintenance is getting high and efficiency is dropping off.

We've got a suggestion for this man (and for you, too). Attend THE MACHINE TOOL EXPOSITION — 1960 and see for yourself why Modern Machine Tools = Production Efficiency. This exhibit, the first since 1955, is sponsored by The National Machine Tool Builders' Association* and will contain eleven acres of the U.S.A.'s newest machine tools under power, cutting and forming metal to demonstrate 1001 ways to lower production costs. Can you afford to stay home?

You're also invited to the PRODUCTION ENGINEERING SHOW on the Navy Pier.

No extra registration needed.

*The N.M.T.B.A. represents 90% of the U.S.A. machine tool industry.

FORMULA FOR TOMORROW

MODERN MACHINE TOOLS MMT=PE PRODUCTION EFFICIENCY

International Amphitheatre
Chicago, Illinois
Sept. 6-16

THE MACHINE TOOL EXPOSITION – 1960

For information write to

NATIONAL MACHINE TOOL BUILDERS ASSOCIATION

2139 Wisconsin Avenue, N.W. • Washington, D. C.

NEW

POP

- *Seal as they set*
- *Designed to form waterproof and air-tight seal*
- *Inserted and set from the same side*

Here's an exclusive new self-sealing blind rivet that solves the problem of achieving a liquid and vapor tight seal in one simple setting operation. Even regular drilled holes are filled completely and access to the reverse side of the work is not necessary.

"POP" Rivets can cut fastening costs 50% and are easier to install than other blind fasteners — even with unskilled help. They can't shake out or strip, even under severe vibration.

They are making unusual savings in fastening time on truck and trailer bodies, refrigeration cabinets, appliances, construction work, vent and duct systems, marine construction and wherever else secure fasteners are needed in place of old style rivets and screws.

Developed over 5 years ago at one of our subsidiary companies abroad, this dynamic fastener is service proved. Now available through our Shelton plant, a full range of sizes is in stock for immediate shipment.

Call or write us for details or check our new catalog in Sweets Product Design File, Section 7 PO.

"POP" Rivet Division
UNITED SHOE MACHINERY CORP.
425 River Road, Shelton, Connecticut
REgent 5-3391

See our Exhibit at the United Shoe Machinery Corp. Booth 924. Design Engineering Show.

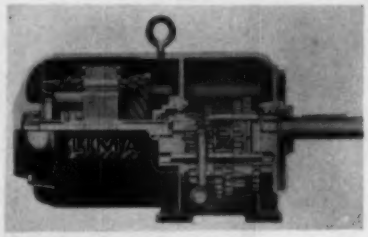
RIVET BEFORE SETTING

RIVET AFTER SETTING

HOW THE CLOSED-END RIVET WORKS

The unique design and special manufacturing process imbeds the setting mandrel into the rivet body. As the mandrel is drawn out with the setting pliers or power gun the rivet generates radial expansion in the hole, providing a positive seal. At the same time it exerts lateral squeeze on the work itself. The mandrel stem then breaks under a predetermined load at a definite location, thereby assuring consistent setting.

UNITED
"POP"
RIVETS



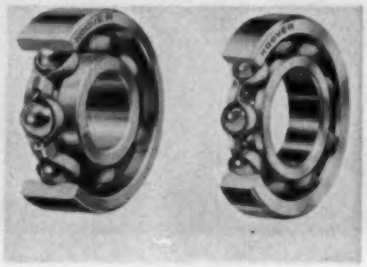
Selective-Speed Drive Mounts in Any Position

Lima Type R3 selective 4 or 8-speed gearshift drive is now available for mounting in any position required —standard horizontal; ceiling; wall, horizontal or vertical, with ouput shaft up or down. Design changes include stress-proof steel shafting in motor and gearbox with hardened splines on the spline shaft for extreme service requirements and long life.

Unit is furnished with standard single-speed motors of 1800, 1200, or 900 rpm. Horsepower ratings are 1, 1½, 2, 3, and 5. Output speeds with 1800 rpm input are: low, 420; 2nd, 555; 3rd, 930; and high, 1730. Two-speed motors are available.

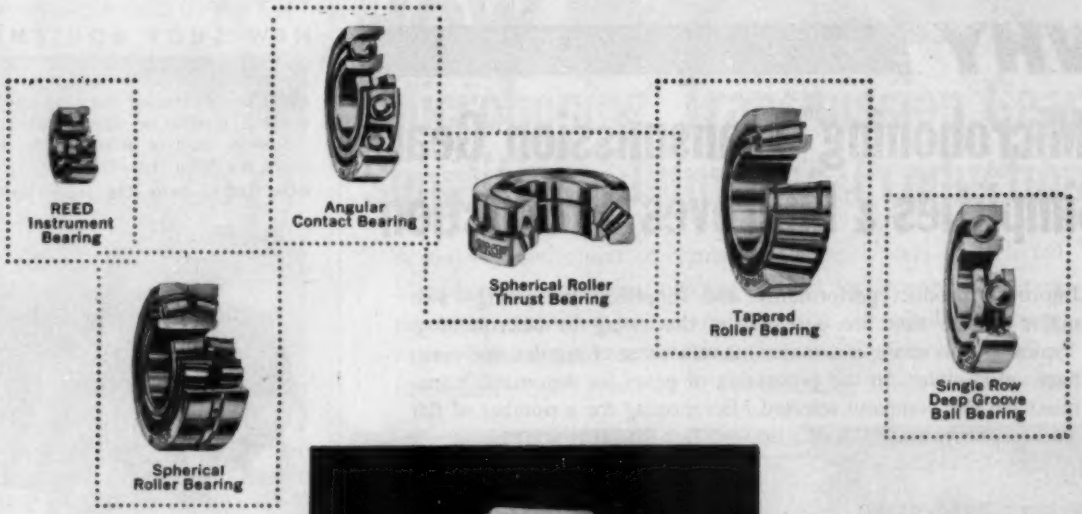
Lima Electric Motor Co, Dept 132, Lima, Ohio

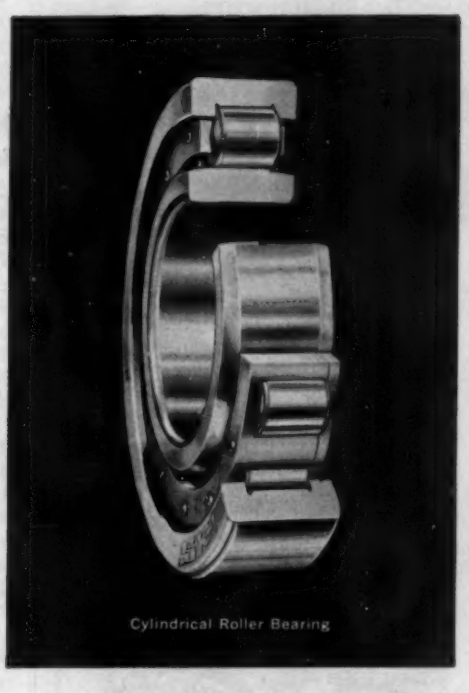
MORE DATA? Circle 117, inside back cover



Two New Series of Ball Bearings Introduced by Hoover

R Series facilitate shaft and housing design because all boundary dimensions—bore, OD, and width—are made to inch dimensions. Compactly designed series, proportionately similar to conventional extra light and light series metric bearings, are offered in 15 sizes for shafts ranging from ⅛ to 1½ in. in diameter. Hoover 30 Series are designed to fill the need for extra-small metric ball bearings for use with shafts and housings of small diameter. Bores range from 4 to 9 mm in diameter, smaller than conventional extra light, light, and medium series. All of these new bearings can be furnished either open or shielded; in





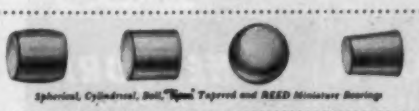
What's a "special size" in production bearings?

SKF makes so many standard sizes, there's practically no such thing as a "special size" of bearing. They range from tiny instrument bearings right up to four-row tapered roller bearings—and account for almost every possible bore size in-between.

Take SKF's standard cylindrical roller bearing, for example. It's promptly available in 154 sizes of single- and double-row types —for shaft diameters ranging from 1" to 9.5". Every size, in both types, offers high radial capacity in relation to its size and operates at highest speeds because of its very low friction.

So, before you specify a "special size" bearing, call the nearest SKF sales office first. The odds are better than 1,000 to 1 that there's already a standard SKF bearing of exactly the size you need. 6007

See them at the SKF Booth #1932 at the Design Engineering Show



EVERY TYPE—EVERY USE
SKF
SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

WHY

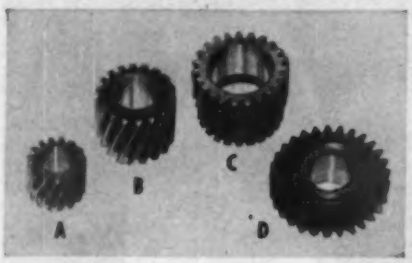
Microhoning* Transmission Gears Simplifies & Improves Production

Improved product performance and simplified processing – two major factors that are accelerating the swing to Microhoning. Typical of this swing is a major manufacturer of regular and compact automobiles. In the processing of gears for automatic transmissions, this company selected Microhoning for a number of flat surfaces, bores and O.D. of a housing hub—HERE'S WHY!

SIMPLIFIES PROCESSING

Double surface Microflat machines simultaneously Microhone both flat surfaces of pinion and sun gears—first, to obtain proper thickness and parallelism on soft gear blanks. This simplifies subsequent operations (boring, hobbing, chamferring, etc.) by eliminating former orienting of gears to a single finished surface.

The second Microhoning of these flat surfaces, after heat-treating to 59 R "C", quickly removes all burrs and generates final accuracies and surface finish.



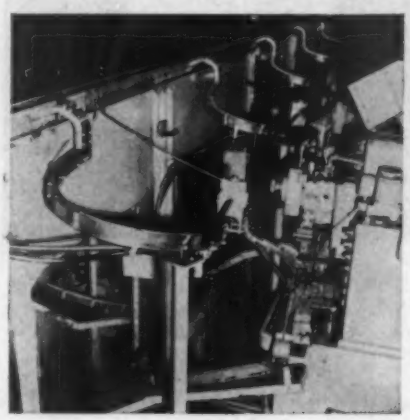
"A"—pinion gear for large transmission "B", "C" & "D"—pinion and sun gears for compact car transmission

EFFICIENT PRODUCTION

After the second flat-Microhoning operation, gears are conveyed to Microhoners for processing the bores. Typical, of the production efficiency realized on all gear bores, is the bore-Microhoning of pinion gears (nine are used in each large transmission).

On eight Microhoners these pinion gears are automatically loaded, positioned, bores Microhoned, checked for size, segregated and ejected (see photo to right). This wholly automatic sequence takes about 18 seconds per gear. Only one set up man is required to keep all eight machines in operation.

An average of .002" stock is removed from each bore; generated surface finish is 10 microinches, rms; roundness and straightness are held within .0001" tolerance; diameter within .0003". Comparable results are obtained on other gear bores (see facing page).



This efficient precision production assures consistent results. Also, reliable precision on component parts is a prime answer to "Why" better performing automatic transmissions are obtained.

*Registered U.S. Pat. Off.

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

addition, 30 Series may be equipped with a single or double seal.

Hoover Ball & Bearing Co, 5400 S State Rd, Ann Arbor, Mich

MORE DATA? Circle 118, inside back cover

New Wound Rotor Motor Line Introduced by Westinghouse

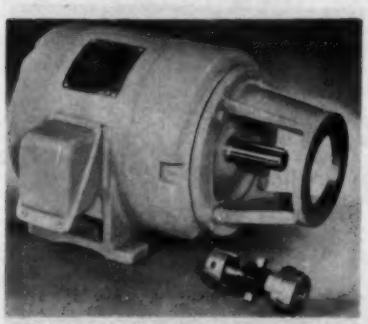
Life-Line A induction motors are designed primarily for adjustable or constant speed drives that require special starting characteristics. Units cover all standard ratings in frame sizes 254 through 326, which represents motors from 2 to 30 hp up to 1800 rpm. They are used wherever high starting torque with low starting current is required.

In superseding the types CWP and CIP wound rotor motors, the new line incorporates a Class B insulation system which offers greater thermal stability, outstanding moisture resistance, and inertness to chemicals and dirt. Motors are supplied with leads for external connection for either 220 or 440 v.

Westinghouse Electric Corp, PO Box 2099, Pittsburgh 30, Pa

MORE DATA? Circle 119, inside back cover

"The boss isn't in. He went to the dentist. One of his fangs has a cavity."



Hydraulic Pump Motors Offered In NEMA Frames 182 Through 215

Designed with an adapter that allows the hydraulic pump to be motor-mounted, the new motor line is available in drip-proof, enclosed, or explosion-proof construction. Motors are offered in all ratings now supplied in the 182, 184, 213, and 215 frames, nominally 1 through 5 hp. Pump mounting adapters can be supplied that will accept pumps of many manufacturers. These adapters are available on both ends of drip-proof and enclosed non-ventilated motors.

Motors can be supplied with a flexible coupling that assures proper shaft alignment and virtually eliminates any unusual bearing loads that might result from misalignment of the motor and pump shafts. Coupling, which has no rubbing surfaces to wear, and requires no grease, can be assembled quickly and easily.

General Electric Co, Schenectady 5, NY

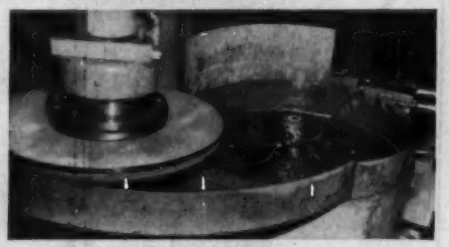
MORE DATA? Circle 120, inside back cover

"I promised my wife I'd hang her picture over my machine."

HOW

Microhoning* Transmission Gears Simplifies & Improves Production

A major manufacturer of regular and compact cars has selected Microhoning as the most efficient method for securing consistent precision, controlled surface finishes, and simplified processing. Microhoning is used on the flat surfaces and bores of a number of transmission gears plus the O.D. of a housing hub. HERE'S HOW!



Flat-Microhoning small transmission gears—head is swung to left for easy loading.

Bore-Microhoning—both spindles fed simultaneously.

FLAT-MICROHONING

Both faces of a variety of transmission gears are simultaneously Microhoned. First, soft gear blanks are flat-Microhoned to secure proper thickness and parallelism within .0003", and a finish of 30 microinches (rms) or better. This simplifies subsequent processing by eliminating formerly required orienting of part to only one finished face.

The second flat-Microhoning of faces, after heat-treating to 59 R "C", quickly cleans up all burrs while generating final accuracies and finishes.

BORE-MICROHONING

The Microhoning of bores for large transmissions is described on facing page. The smaller transmission uses pinion and sun gears having various bore sizes (.697"D. x 3/4"L., .697"D. x 1-3/32"L., 1.030"D. x 7/8"L.).

To generate roundness, straightness, size and surface finish, these bores are processed on double-spindle Microhoners equipped with shuttle-type fixturing. Straightness and roundness are held within a .0003" tolerance, diametric size within .0005". All gear bores are processed in an average 26-second cycle that includes loading, Microhoning and ejection.

O.D.-MICROHONING

The converter housing hub of the large transmission is also Microhoned. Hub O.D. is 1.936", length is about 2", and it has a blind end with 1/4" relief. Two progressive Microhoning operations remove a total of about .004" stock to generate a surface finish of 15 microinches in a cycle time of 45 seconds per part. Special Microhoning technique generates circumferential lay on hub O.D. to provide compatibility between it and oil seal rotation. *This increases seal life and effectiveness.*

**Registered U.S. Pat. Off.*

PRECISION PRODUCTION THROUGH MICROHONING MICRO MATIC

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

feature by feature... the latest

LINLEY

JIG BORER

IS A TOP PERFORMER IN TODAY'S TOOLROOMS WHERE ACCURACY IS ESSENTIAL

1. Accurate to a high degree, the Linley is fast to set up and position and has the versatility required for precision tool work.
2. Ribbon type locks on both table and saddle for positive no-shift locking add to its dependability and lasting accuracy.
3. A tiller-type wheel facilitates final adjustment of the sliding head, raising and lowering it rapidly to exact degree desired.
4. A pin type lock for the spindle, speeds insertion and removal of tools and requires only one spanner wrench instead of two.
5. Feed screws on both table and saddle are an extra large size, ⅞" diameter, and heat treated for long wear with extreme accuracy.

Designed And Built For Precision Operation

The Linley Jig Borer is a precision machine designed specifically for small tool and die work and reasonably priced. It is available with many time saving accessories that add to its usefulness and speed.

We invite your inquiries; write for specifications, prices.

LINLEY BROTHERS CO.
664 STATE ST. EXT. BRIDGEPORT 1, CONN.

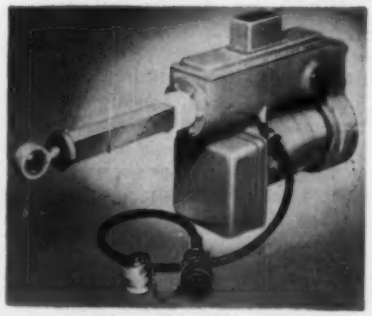
NEW SHOP EQUIPMENT

Torque Holder Designed For Soft Face Hammers

Holder, tradenamed Stub'n, features a new shock plate design which dissipates shock and percussion waves and distributes the striking force equally throughout the hammer. Manufacturer states that the holder will not twist or wrench under violent blows.

Nicholson File Co, Providence, RI

MORE DATA? Circle 121, inside back cover



Lear Introduces Actuator Line Designed for Industrial Use

First in a new line, Model 499B is a heavy-duty electrically driven linear actuator suitable for use wherever open-loop positioning is required. Unit can move up to three quarters of a ton and can hold a ton and a half. A brake is used to reduce overcoast to a minimum.

Stroke is continuously adjustable from 4.25 to 5.25 in. Also available is a second version of this actuator, designated Model 499B-1, which offers a shorter stroke of from 2.75 to 3.75 in. The self-contained unit, which requires only line current for instant operation, is powered by a single-phase 115-v, 60-c motor capable of developing 0.14 hp at 5000 rpm.

Lear Inc, PO Box 688, Grand Rapids 2, Mich

MORE DATA? Circle 122, inside back cover

RUGGED to full tool capacity!

...FOR LONG WORKING LIFE
TO ELIMINATE DOWNTIME & PRODUCTION LOSSES!

THOMSON
THRIFTMASTER DRILLHEADS

DRILL • TAP

REAM • BORE

COUNTER-BORE

COUNTER-SINK

FACE

Tremendous economies from the use of multiple-spindle drill-heads are obvious. Use *THOMSON* THRIFTMASTER Drill-heads for optimum performance and profits. *Ask NOW for our new catalog.*

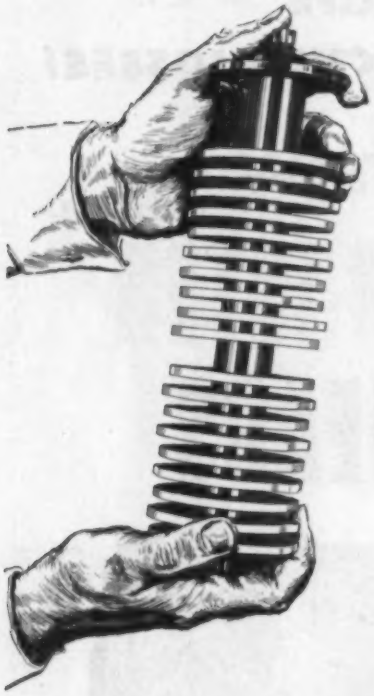
THRIFTMASTER
PRODUCTS CORPORATION

1016 NORTH PLUM ST.
LANCASTER, PENNA.
EXpress 2-2101

Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS

Subsidiary of
THOMSON INDUSTRIES, INC.
makers of BALL BUSHINGS • NYLINERS • 60 Case Shafting

He's holding an automatic cycle



Multi-cycle programmer is the name. And it's only one of many built-in features which make the Monarch Model 21 Mona-Matic the most productive automatic cycle lathe available today.

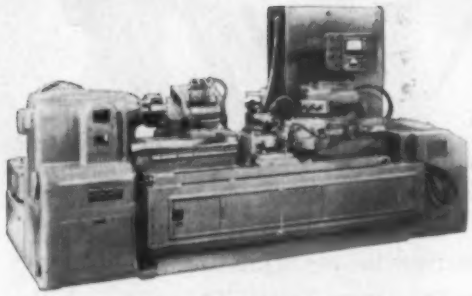
You can use the Model 21 for a hundred or a million parts. The programmer method cuts setup time to such an extent that switching over from one part to another is accomplished just about as quickly as job change on an engine lathe.

The Model 21 has all the power needed to utilize the full productiveness of carbide tooling; has the speed to fully realize the economies inherent in ceramic tooling.

This machine may be used with equal efficiency on one, two, three or four cut cycle work while the switch from one cycle to another is accomplished in most cases by doing nothing more than changing multi-cycle programmer and making a few quick readjustments.

Get all the benefits of the time-proved "Air-Gage Tracer"—the most accurate lathe duplicating device known. It's so fast in operation that the only limitation in cycle speed is imposed by what the tool will stand.

When you buy a production lathe, RESULTS are what you want. That's what you get in the Model 21. Booklet 1808, yours for the asking, tells why in detail... **The Monarch Machine Tool Co., Sidney, Ohio.**



- Exclusive automatic feed change with up to six different feeds, each of which is infinitely variable and each of which may be made operative at any time during the cycle.
- All feeds adjustable under cut. This often lengthens tool life and thereby increases day in and day out productiveness.
- "Air-Gage Tracer" utilizes the combination of air-hydraulic control with a stylus pressure of only five to six ounces against the template. There is no appreciable template wear; accuracy of template shape reproduction is within ±.001" on most jobs.
- All way surfaces flame hardened and ground. The accuracy built in is retained year after year.
- Work piece change speeded by a single multiple position lever on tailstock. In proper sequence it controls both the tailstock center and the air operated chuck.
- Rugged rear carriage for auxiliary machining operations, timed to take its cut at any point during the cycle.
- Automatic lubrication; from end to end, all the time.

Flexibility Unlimited

With such optional equipment as (1) inbuilt constant surface cutting speed, (2) automatic indexing two-position tool holder, (3) power chip conveyor and (4) chip and coolant guard.

Monarch
TURNING MACHINES
FOR A BETTER TURN FASTER... TURN TO MONARCH

FIELD REPORT...

Sheffield's Movable Laboratory Controls Temp to ¼ Degree

Sheffield Corp has come up with a portable controlled environment enclosure called Pre-Fab-Lab that controls temperature to within ¼ F and relative humidity to less than 50%. The 16 x 24 x 13-ft-high unit can be knocked down and set up in 24 hours and can be moved about as requirements demand. Sheffield has been using one of these lab enclosures in its general plant area for the past eight months; it's proved so satisfactory that three standard design sizes have been made available.

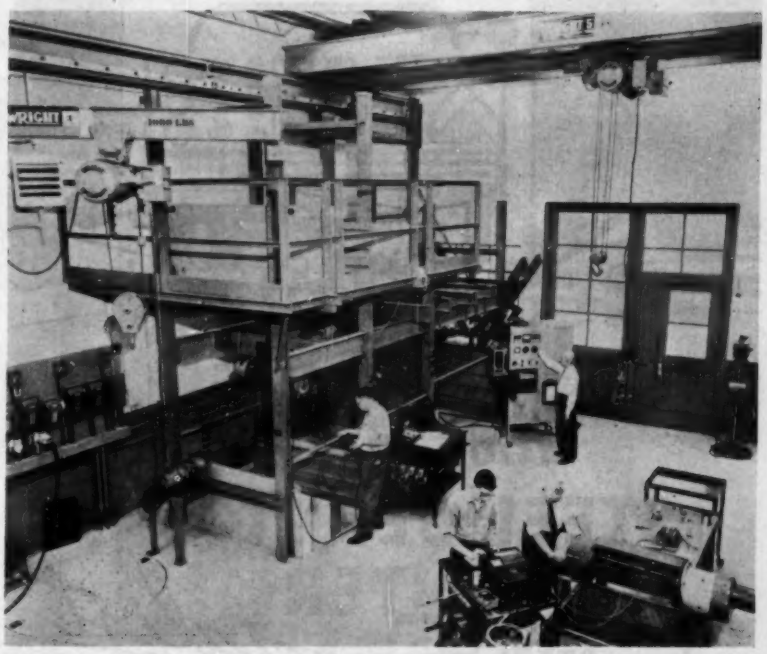
Fruehauf Plans to Produce $15 Million in Components

Press program to produce $15 million worth of component parts annually has been inaugurated by Fruehauf Trailer Co of Detroit. New press and shear operation at Avon Lake, Ohio, will manufacture components that are now being purchased at a considerably higher cost. Two additional facilities scheduled for completion this year indicate the company's increased manufacturing activities. A tank plant is under construction in Uniontown, Pa, and a 265,000 sq-ft plant to be built in Bucks County, Pa, will manufacture railroad cars, containers, and standard motor freight line vans.

Bell Aircraft to Sell Three Major Operations to Textron

Bell's Niagara Frontier Division, its helicopter subsidiary, and the Hydraulic Research and Manufacturing facility at Burbank, Calif, are being sold to Textron Inc of Providence, RI. It's estimated that Textron's cash purchase of these Bell operations will involve more than $30 million; they'll be known as the Bell Aerospace Corp, a wholly owned subsidiary of Textron. Bell Aircraft Corp will continue to exist but it'll be entirely out of the defense and aviation business. Headquarters of Bell Aerospace will be at the present Buffalo plant.

Bell Aircraft directors broke up the company into two groups—defense and commercial. It'll retain the commercial group; all of the defense operations being bought by Textron will remain at their present locations.



Engineering lab for testing new product designs is in operation at American Chain & Cable Co's York, Pa, manufacturing facility where the Wright Hoist Division makes overhead material handling equipment and the ACCO Equipment Division produces hydraulic presses. Test floor area of 1800 sq ft and 480 sq-ft mezzanine area are serviced by a 5-ton-capacity overhead 3-motor Wright Speedway electric hoist and an auxiliary wall-bracket 3-ton jib crane for quick placement of heavy test objects. A 20-ft-deep test pit in one corner of the lab is used for gravity loading of hoists up to 25-ton capacity

$11 Million Freight Car Order

Atlantic Coast Line Railroad has placed orders for 1000 new freight cars costing more than $11 million. New equipment will be built by American Car & Foundry Division of ACF Industries, Greenville Steel Car Co, and Pullman-Standard Division of Pullman Inc. Delivery is scheduled to begin in July and be completed in September.

Giddings & Lewis . . .

. . . Fond du Lac, Wis, is changing the tradename of Cincinnati Bickford radial and upright drilling machines to G&L/Bickford. G&L has owned the line of machines since 1955 when it purchased the old Cincinnati Bickford Tool Co. The new name also will be applied to uni-

McGIRK'S WORKS by GEO. CRENSHAW

YA GOTTA ADMIRE WEMBLY, HE WORKS HARD, HE'S KIND TO ANIMALS, AND DOESN'T SMOKE, DRINK, SWEAR OR GAMBLE!
YEA, BUT NOBODY'S PERFECT. I'LL BET IF YOU GOT TO KNOW HIM...
PAINT DEPT.
...YOU'D FIND HE HAD SOME KIND OF WEAKNESS!
MOE'S CORNER
We all have our human weaknesses. Take me fer instance...I can resist everything but TEMPTATION.

YOUR LOCAL

STEEL SERVICE CENTER

is a STEEL *Specialist*

with years of experience and know-how in maintaining diversified stocks of all types of cold finished steel bars. He can reduce the cost of your in-plant inventories by making quick deliveries for your production demands. To be sure of the finest cold finished steel bars—always specify Wyckoff.

MANUFACTURERS OF COLD FINISHED STEELS EXCLUSIVELY

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Works: Ambridge, Pa. • Chicago, Ill. • Newark, N.J. • Putnam, Conn.

WYCKOFF STEEL PRODUCTS
Carbon, Alloy and Leaded Steels • Turned and Polished Shafting • Turned and Ground Shafting • Large Squares • Wide Flats up to 12¾" x 2¼" and 14" x 1¼" • All types of Furnace Treated Steels including Carbon Corrected Steels

Field Report . . .

versal radial drilling machines built by G&L in Kaukauna, Wis. Name change is being made concurrent with the sale of the Cincinnati plant and centralization of drilling machine manufacturing in the Wisconsin facilities.

National Broach Sets Up Computer Lab in Engineering Dept

Electronic digital computer equipment will be used by National Broach & Machine Co, Detroit manufacturer of gear production equipment and broaching tools, in the design of gear shaving cutters, gear honing tools, master gears, and broaching tools. Extensive analytical work on design of gears and splines and related tooth shapes will also be carried out on the new equipment. Gear production tools have always required more mathematical calculations and analysis than any other tools used by the metalworking industry. Computers will be a boon in this field.

Lobeck to Market British Casting Machine

Lobeck Casting Processes Inc, New York, has concluded a marketing agreement with Sheppard & Sons Ltd, leading British manufacturer of ingot casting machines for ferrous and non-ferrous metals. Range of Sheppard casting machines covers both single and multiple-strand units designed to handle such metals as iron, aluminum, zinc, lead, copper, nickel, and their alloys. The firm's booster-driven zinc slab casting machine has been particularly successful and is regarded as standard

"'Bet I can get it all in one trip'—Hal"

SND—A NEW NATURAL DIAMOND GRIT FOR HIGHER GRINDING EFFICIENCY

Announcing

The development of a New diamond grinding material—

SND (Selected Natural Diamonds)

and

The development of a process for increasing the friability of natural diamond grit—Treated SND (Selected Natural Diamonds)

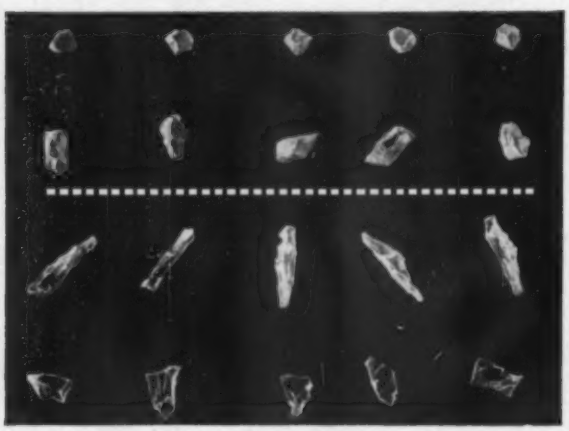
for progressive diamond wheel users . . . . . >

SND — a new natural diamond

SND—THE LATEST TECHNICAL DEVELOPMENT FOR IMPROVING CARBIDE GRINDING PERFORMANCE

SND (Selected Natural Diamonds) is a *New* natural diamond abrasive developed especially for resinoid bond grinding wheels. It is made up of needle shaped grains and thin, flat platelets selected from diamond boart that has been crushed by a special method.

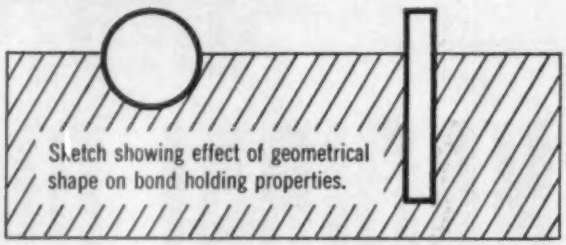
Diamond particles at least twice as long as they are wide are classified as "needles," and particles that are less than one-quarter as thick as they are wide are classified as "platelets."



Top: Blocky diamond particles predominating in conventional grit.

Bottom: Needle and platelet diamond particles predominating in new SND Selected Natural Diamond grit.

Why "needles and platelets"?



Sketch showing effect of geometrical shape on bond holding properties.

For many years, blocky shaped diamond particles were considered ideal for any type bond grinding wheel. Recent laboratory research into the influence of particle shape on grinding efficiency proved that blocky particles were *not* as efficient in resinoid bond wheels as were thin, flat and needle shapes.

Subsequent tests bore out the important facts that, blocky shapes either wore down level with the matrix, or were pulled out of the bond; while needles and flats seldom pulled out, and instead of wearing smooth, tiny bits broke off in a manner which constantly exposed new, sharp cutting diamond edges to the work.

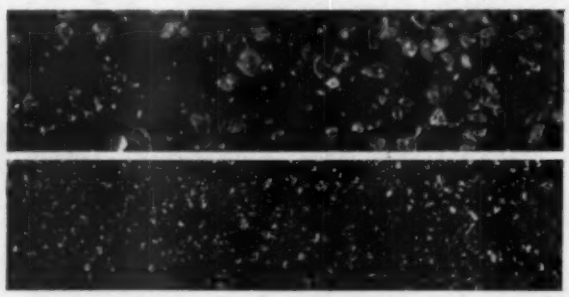
Tests verified by sludge analysis

Analysis of the sludge and swarf collected after tests of both SND and conventional grit wheels verified the test findings. Only uniformly tiny diamond particles were found in residue from SND wheels, proving that each SND particle was almost wholly utilized in the grinding process.

Conventional natural diamond grit sludge ▶

The absence of large particles in SND—Selected Natural Diamonds sludge shows *why* SND gives up to 30% longer wheel life and increased wheel efficiency over conventional diamonds.

SND-Selected Natural Diamond grit sludge ▶



grit for higher grinding efficiency!

How SND (Selected Natural Diamonds) increases grinding efficiency

SND provides more sharp cutting edges per carat in the same grit size.

More cutting edges means a faster, cooler cutting wheel that will last up to one-third longer than resinoid wheels made with conventional grit.

The thin needle and flat grains in SND possess the right amount of natural strength, yet break down easily for fast, free, and continuous cutting.

SND grit offers maximum holding surfaces to the bond, reducing non-productive pull-outs.

SND sharper cutting edges reduce wheel loading and glazing.

Proved in laboratory runs . . .

Extensive laboratory runs show SND grit is up to 30% more efficient than conventional grit when grinding cemented carbide at .0005″ to .0015″ in-feeds and speeds of 5500 S.F.M.

Proved in the field

Many metalworking plants now are proving the new SND grit in their own shops with results that substantiate the already-completed laboratory evaluations.

TREATED SND—ANOTHER NEW GRIT DEVELOPMENT!

A process for treating SND (Selected Natural Diamonds) grit to make it even more friable and to give it superior bonding properties in resinoid wheels also has been developed. This process introduces surface irregularities in the otherwise smooth planes of the SND particles; these tiny cracks and crevices promote faster breakdown after wear and stronger bonding. Already proved to be more efficient than conventional grit at feeds of .0005″ to .0015″, on carbide, Treated SND is recommended only for lighter feeds, and where the nature of the work demands rapid grit particle breakdown.

The selection is yours . . .

SND grit—for tough applications.

SND Treated grit—for light feeds and coolest cutting.

Conventional grit—for heavy feeds (.003″ and up) and the recommended material for metal or vitrified bond wheels.

Available now

Your diamond wheel supplier can now furnish you with grinding wheels made with the new SND grit—either treated or untreated—ask him about SND today!

Diamond experience

Ready to discuss your diamond problems are Industrial Diamond Division Field Engineers located in key metal-working centers. These are technical men with natural diamond backgrounds and experience. Field offices are in Boston, Chicago, Cleveland, Detroit, Los Angeles, Newark, New York and Philadelphia.

Technical information service

A new and complete technical information service to help keep you abreast of the latest developments in industrial diamond technology has been established. Monthly Diamond Data and Technical Bulletins will be sent you without obligation. Simply send us your name, title and company address.

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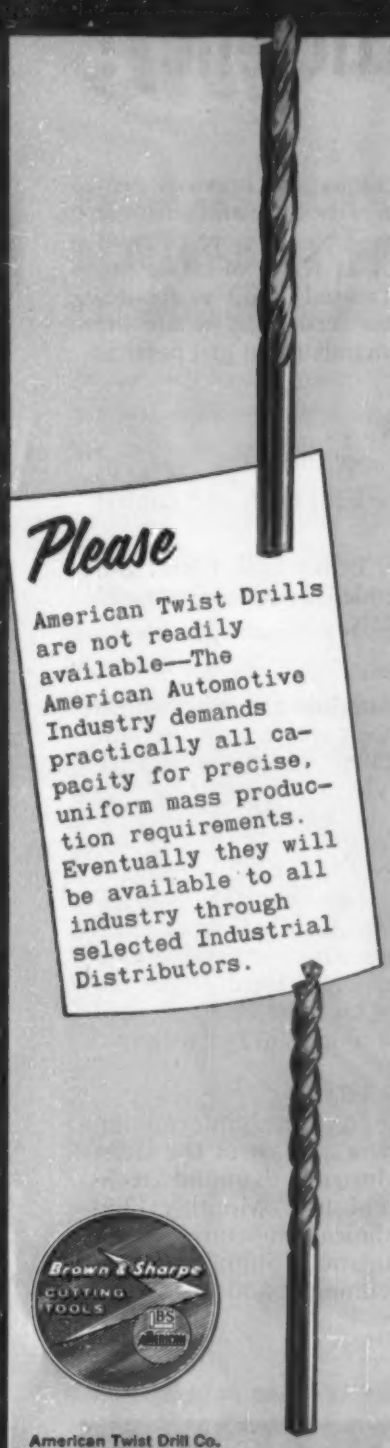
Please
American Twist Drills are not readily available—The American Automotive Industry demands practically all capacity for precise, uniform mass production requirements. Eventually they will be available to all industry through selected Industrial Distributors.
Brown & Sharpe
CUTTING TOOLS

American Twist Drill Co.
Detroit, Michigan
Subsidiary of:
Cutting Tool Division
Brown & Sharpe Mfg. Co.,
Providence 1, Rhode Island

AMERICAN

Field Report . . .

equipment throughout the world. These machines complement Lobeck's line of fully continuous and semi-continuous billet, slab, and bar casting equipment.

Bendix Gets $21 Million for Eagle

A $21 million contract for continued development and evaluation of the Eagle missile system has been awarded to Bendix. Eagle will be a long-range, air-to-air, high performance guided missile "for destroying any enemy aircraft or aerodynamic guided missile expected in the foreseeable future."

Order is in addition to the R&D contract previously awarded the company. Principal subcontractors associated with Bendix in the Eagle program are Grumman Aircraft Engineering Corp, Bethpage, LI, NY; Sanders Associates, Nashua, NH; Litton Industries, Beverly Hills, Calif; and the Air Arm Division of Westinghouse Corp, Baltimore. In addition to Bendix Systems as prime contractor, two other divisions of Bendix are working on the Eagle project—the Research Laboratories Division, Detroit, which will develop electronic guidance equipment; and the Bendix Pacific Division, North Hollywood, which will design and produce subsystems and perform missile assembly and tests.

Ellicott Machine Acquires Brandt Plant Property

Ellicott Machine Corp, Baltimore, has acquired the plant of Charles T Brandt Inc, also of Baltimore. Facility consists of about 200,000 sq ft of manufacturing buildings located on 17 acres of property. Plant will be operated by Ellicott-Brandt Inc, a wholly owned Ellicott subsidiary.

The Brandt company has been producing specialized metalwork for private industry and government, including a variety of pressed shapes, medium to heavy weldments, stampings, and various ordnance components and assemblies. A 30-ft press brake is being installed to handle single-piece formed shapes of extended length.

Douglas Shifts Rocket Work

Army free-flight weapon systems responsibilities have been assigned to the Charlotte, NC, division of Douglas Aircraft. Formerly under the supervision of the Santa Monica, Calif, division, responsibilities will include direction of proposal, research, development, and production for Army rocket programs. The Charlotte Army Ordnance plant, operated by Douglas, formerly was responsible primarily for manufacture of Nike series missiles; relocation of the rocket work to North Carolina will allow closer liaison with the Army's Redstone Arsenal at Huntsville, Ala.

The Charlotte division also has a $1.6 million contract for production of the improved Honest John, Army nuclear-tipped ballistic missile. The redesigned weapon is lighter, shorter, more accurate, and has greater range than the earlier version already deployed with Army troops The Nike Hercules engineering and field testing responsibilities at Charlotte are being enlarged and the division figures prominently in the planned Nike Zeus production program.

To support the added programs at Charlotte, aerodynamics and advance design sections have been formed in the Engineering Department. Creation of other technical groups including engineering computing, data engineering, and ground equipment will result in the addition of approximately 100 engineers by midyear.

Yale & Towne Cincinnati Branch Becomes Moon Equipment Co

The Cincinnati Branch of Yale's Materials Handling Division has been purchased by the newly formed Moon Equipment Co. The company, to be headed by Harold E Moon, formerly Yale Cincinnati Branch manager, will maintain headquarters at the recently enlarged facilities ac-

"Just where is this good nature of yours that I'm always taking advantage of?"

Dual-bolster design permits tooling up of one bolster (left) while press is producing parts from die on the other. This press, at the A.O. Smith Corp., Milwaukee, Wis., has proved the economy of this design for the past 2 years.

Press downtime...cut from hours to minutes with the Hamilton dual bolster press

Hours — sometimes days — formerly wasted in changing dies can be used productively with the Hamilton sliding dual bolster press. While the operating bolster and die are turning out parts, the second bolster is being tooled up for the next production run. Push-button-controlled hydraulic motors position the standby bolster fast and surely for rapid startup and production of the next part — changeover time is a matter of minutes only.

A 1250-ton, 2-point, top-drive press equipped with two sliding bolsters installed at a Midwest automobile parts plant is proving the economies of this innovation—on parts up to 12 ft. long. Reduced parts inventory, meeting schedules on time, and fewer presses needed to accommodate frequent die changes are among the benefits resulting. For detailed information on the new Hamilton dual bolster press, write Dept. P-1.

BALDWIN · LIMA · HAMILTON

Industrial Equipment Division · Philadelphia 42, Pa.

HIGH-SPEED TAPPING with HI-SPI

Hi-Spi is made as small as No. 3 (.099). Shown actual size.

The new Hi-Spi Taps match the higher speeds of modern machines giving a greater number of precisely tapped holes per hour with a minimum of tap wear and breakage.

The new Hansonized Hi-Spi Tap has the ultimate in hard finish without embrittlement. This eliminates chip removal and welding problems prevalent with difficult metals. Tap life and accuracy are markedly increased.

Hi-Spi Taps, made only by Hanson-Whitney, will out-perform any other standard tap made . . . and they are stocked by leading Industrial Distributors.

Ask your Distributor or write for the new H-W **Tap Selector** that shows how to quickly select the right taps for any metal. It's free.

THE Hanson-Whitney COMPANY

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TAPS • GAGES • COMPARATORS • HOBS • CUTTERS

Field Report . . .

quired by Yale. Moon Equipment is the franchised representative for Yale equipment in southwestern Ohio and northern Kentucky.

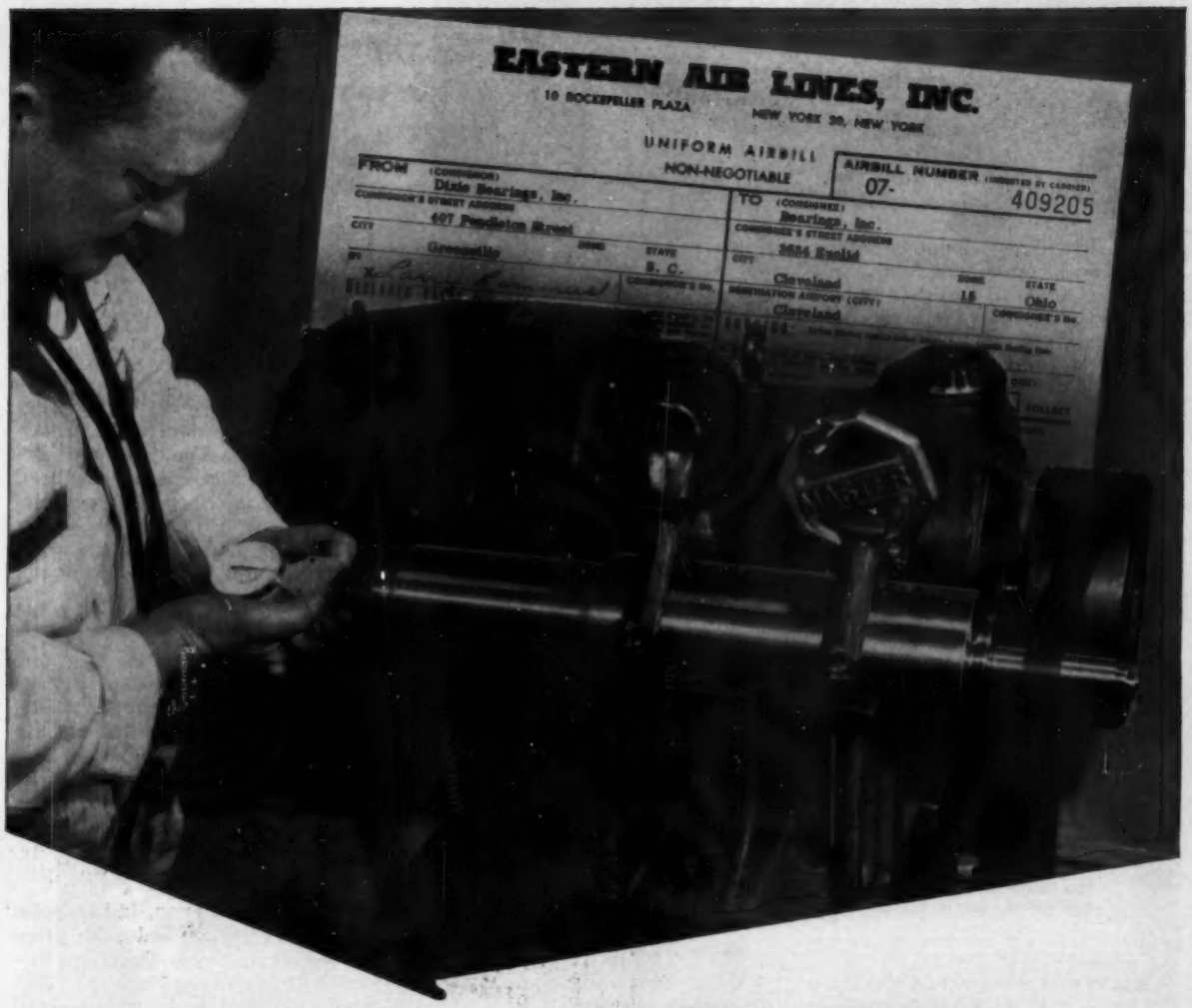
Ohio Machine Firm Acquired By McGraw-Edison

McGraw-Edison Co, Elgin, Ill, firm in the electrical manufacturing industry has completed negotiations for the acquisition of assets and business of American Laundry Machinery Co, Cincinnati, in a transaction reported to involve more than $33.5 million. Subject to approval of American shareholders, the deal is expected to be completed by the end of next month with American operated as a division. The company manufactures and sells commercial laundry and dry cleaning equipment. Main plants are in Cincinnati; Rochester, NY; Salt Lake City; Milwaukee; Toronto; and in England.

Lockheed Develops Aircraft for Mexico

Federal Aviation Agency has granted a type certificate for the LASA 60, a new light single-engine craft to be produced by Lockheed Azcarate, a partnership between Lockheed International and a group of Mexican business leaders. The bush craft represents a major departure for Lockheed and is the result of the combined efforts of two Lockheed divisions and Lockheed International. Original preliminary design work was undertaken by Lockheed's California division in 1958; project was later assigned to a Georgia di-

"There's a lot of teamwork around here, and it's got to stop."



2 worn-out spindles received early Sunday... 2 rebuilt spindles in service Monday morning, 600 miles away!

The customer was in Greenville, South Carolina working on a time contract with stiff penalties for failing to meet the deadline. The spindles on two of their most important machine tools failed almost simultaneously and there were no spares available.

Our subsidiary, Dixie Bearings, Inc., was called late Saturday; our Spindle Repair Department in Cleveland alerted and, with the cooperation of Eastern Airlines, the spindles were in our shop early Sunday. By working all day Sunday, the spindles were back in Greenville and in operation on Monday morning!

This is only one of the many bearing services we provide. For fast help in solving any problem involving bearings—for quick delivery of any nationally known make of bearing—call the branch nearest you, day or night!

Providing bearing service in the North ➤ **BEARINGS, INC.**

OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield • Painesville • Toledo • Youngstown Zanesville • **INDIANA:** Ft. Wayne • Indianapolis • Muncie • Terre Haute • **PENNSYLVANIA:** Erie • Johnstown • Philadelphia • Pittsburgh • York **WEST VIRGINIA:** Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden • Newark **NEW YORK:** Bolanrol Corp., Buffalo • Niagara Falls • **MARYLAND:** Baltimore • **DELAWARE:** Wilmington

and in the South ➤ **DIXIE BEARINGS, INC.**

FLORIDA: Jacksonville • **GEORGIA:** Atlanta • **KENTUCKY:** Louisville • **LOUISIANA:** Baton Rouge • New Orleans **N. CAROLINA:** Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville • Nashville **VIRGINIA:** Norfolk • Richmond

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Time you got acquainted with the world's first* and finest gage blocks. Blocks possessing correct temperature coefficient—absolute metallurgical stability. Blocks with a positive built-in wear factor—unconditionally guaranteed to be minus nothing from nominal size. Blocks, too, that feature chromium plated gaging surfaces to give you longer wearing millionths and lower gaging costs. Yes, it's time now to buy a set of

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"W" Working Accuracy: +.000008"/−.000000"
Parallelism: .000004" / Flatness: .000004"
"I" Inspection Accuracy: +.000004"/−.000000"
Parallelism: .000003" / Flatness: .000003"
"L" Laboratory Accuracy: +.000002"/−.000000"
Parallelism: .000001" / Flatness: .000001"

Above: Ellstrom Rectangular Set No. 92-R. Right: Ellstrom Square Set No. 81-SA, with accessories.

New Catalog contains prices and specifications—send for it today!

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Originators of Chromium Plated Gage Blocks

*Ellstrom—*Measuring in millionths for three generations*

Hjalmar Ellstrom (1863-1942)—He gave mankind the key to mass production of interchangeable parts. For it was he alone who conceived and produced the world's first combination gage blocks—the first master reference standards accurate to the infinitesimal millionth part of an inch!

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The modern metalworking fact you want—when you want it!

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American Machinist's Handbook

Edited by Rupert Le Grand, Senior Associate Editor, American Machinist/Metalworking Manufacturing. 45 big sections. 80% rewritten. 1679 pages, 774 illustrations, $13.00. See this big practical guide 10 days FREE. Pay on easy terms if you keep it. Send coupon now.

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Field Report . . .

vision engineering group. In addition to the development of the design, construction of two prototypes, and completion of FAA certification, the Georgia division is providing Lockheed Azcarate with a complete manufacturing package that includes the Mexican factory layout and equipment specifications, all factory tooling and procedure, and a master scheduling and manufacturing plan. Lockheed Azcarate has also licensed Aeronautica Macchi, Milan, to produce the plane in Italy.

New Corvus Contract to Temco

A $1.6 million order for flight test work and services on the Corvus air-to-surface attack missile has been awarded by the Navy to Temco Aircraft, Dallas. It follows an earlier $25 million allocated to the company for continued development and testing of the Corvus system.

Blaw-Knox Co . . .

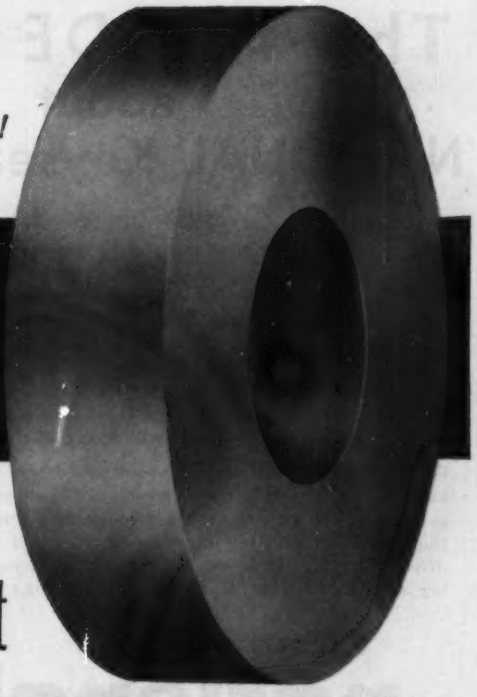
. . . Pittsburgh, is developing plans for a modernization program estimated to cost between $12 and $15 million. Improvement program, soon to be spelled out in detail, will be centered largely in major properties serving the metallurgical industries.

Allison Contracts

GM's Allison Division, Indianapolis, has a $11.6 million order for propjet engines to power three new aircraft soon to enter service—the Lockheed GV-1, a dual-purpose aerial tanker and global assault transport; the Grumman W2F-1, a twin-engine Airborne Early Warning aircraft,

"Oh no, it's not that—I always sort of enjoy my job, once I'm actually here!"

This disc ground roller needs no lapping!



This 1⅞" dia. x ½" steel roller was production ground to lapped tolerances in a BESLY DH4 grinder at a rate of 240 per hour. Size was held to ±.0001", flatness and parallelism to .000075", finish to better than 4 micro-inch. Stock removed was .0004". *Normal lapping operation was eliminated!*

If your grinding equipment can't turn out such results...**Better see Besly!**

BESLY DH4 double horizontal spindle disc grinder. Has *exclusive* precision quill and clutch infeed that provides feed increments calibrated in *millionths*. Abrasive discs can be changed in 30 minutes without disturbing setup, *cutting downtime in half*. Dressing time is only four minutes, *⅛ the usual time!* Simplified push-button operation and controls, built-in dials, gages and meters to indicate abrasive conditions, movement and alignment; motor load, etc., assure precise results, dependable grinding production.

Get all the facts. Write for the Besly DH4 Bulletin, Now!

MMT·PE

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BESLY-WELLES CORPORATION

120 Dearborn Avenue, South Beloit, Illinois

Grinders and Abrasives • Taps • X-Press Taps® • Drills, Reamers • End Mills • Tool Bits
Gages • Carbide Tipped Tools, Blanks, Inserts and Holders

The INSIDE STORY about NATIONAL Keyseating Millers

NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

CUTTERS are made from high speed steel which are hardened to Rockwell specifications and accurately ground to size. Tops of teeth are staggered to break chips which reduces strain and wear on both cutter and driving pins. It will pay you to put National Keyseating Millers on the inside of your next keyseating job.

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CINCINNATI 22, OHIO

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complete, handy size

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Multiple-Spindle Machine with 81 clearance between columns, drills, reams and chamfers holes in tube sheets of various sizes. Electric control provides means for determining hole pattern through selection of in-line spindles and control of two-way, positive-positioned hydraulic indexing work table.

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- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
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MOLINE TOOL COMPANY
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REPRESENTATIVES IN PRINCIPAL CITIES

107

Field Report . . .

and the Lockheed P3V-1, a four-engine anti-submarine warfare version of the commercial Electra.

A new $8.5 million contract has been received by Allison's Transmissions Operations. This supplementary order is for CD-850-6 transmissions and spare parts for use in M-60 tanks.

Emerson Electric Building Ninth

A factory in Russellville, Ky, will be built by Emerson Electric Mfg Co, St Louis maker of electric motors, heating and air conditioning equipment, and electronic avionic equipment. Facility will be the ninth major plant for Emerson; combined cost of factory and machinery will be approximately $2 million with employment expected to run about 550.

Chrysler Gets $10 Million Order

Chrysler Corp has a $10.8 million contract from Army Ordnance for production of 2500 three-quarter-ton trucks. Included in the order for the 4x4 tactical military vehicles are M-37 trucks, truck chassis and cabs, and ambulances. Production, scheduled to begin late in the summer or in early fall, will be carried out at the Dodge Truck Plant in Warren, Mich.

Republic Steel's . . .

. . . large-diameter pipe mill at Gadsden, Ala, has resumed operations after having been shut down since end of February. Company announced at that time that it had several pipe orders but couldn't begin

"Please, Mr Buxton—Mr Miller was bawling me out first!"

On-the-spot deliveries of ALCOA ALUMINUM FASTENERS!

Need aluminum fasteners fast? That's why there's a local distributor of Alcoa® Aluminum Fasteners in your Yellow Pages. That's why he maintains full stocks of Alcoa Aluminum bolts, nuts, rivets, machine screws, wood screws, sheet metal screws, washers—anything you need in standard types and sizes. That's why you can telephone *any* time and get quick delivery, unsurpassed service.

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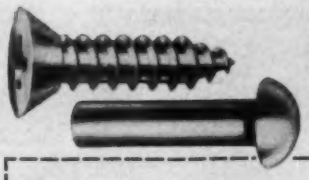

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and "Alcoa Theatre" alternate Mondays, NBC-TV

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Please send me complete specification data and samples of Alcoa Aluminum Fasteners.

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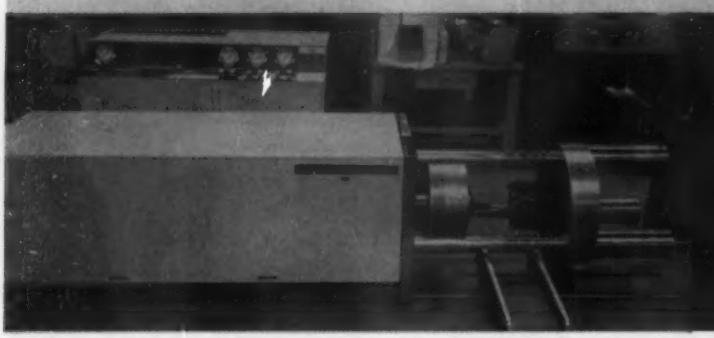
EVIDENCE

▶▶ *Here is clear evidence that high velocity extrusion of metal has dispersed stringy non-metallic inclusions. The part pictured is a hinge pin for* USAF's *B-58 Hustler. The pin on the left was machined from* AISI *4335 modified bar stock. The clearly visible inclusions made the part unfit for service. The pin at the right is made from the same material, but only after it had been extruded at very high velocities by a* DYNAPAK *machine. The inclusions have been eliminated. The part is completely satisfactory. There is no need to change to a more costly metal, or to resort to special mill heats.*



Pneumatically energized DYNAPAK, a product of General Dynamics Corporation, is industry's first practical tool for high-energy-rate metalworking. Many industries are now adapting DYNAPAK to the solution of forging, forming, and extrusion problems. The experience of Convair Fort Worth with these hinge pins gives evidence of another of DYNAPAK's advantages. The hydrodynamic behavior of metal when it is worked at DYNAPAK velocities, results in homogeniety and refinement of structure, and in dispersal of inclusions.

for complete information, write, wire, or phone:

DYNAPAK

CONVAIR / A DIVISION OF GENERAL DYNAMICS CORPORATION

1243 Transit Avenue, Pomona, California • Phone: NAtional 3-1561

production on them until clearance came from governmental regulatory agencies. The 24-in. line pipe order on which work has started will keep the mill in production at least 8 to 10 weeks, according to a Republic spokesman.

$10.5 Million Thiokol Order

Continuation contract for production of rocket motors and plant maintenance at its Longhorn Ordnance Works at Marshall, Texas, has been awarded to Thiokol Chemical Corp. Company has operated the Longhorn Division since 1952 and is producing rocket motors for such operational missiles as the Falcon, Nike-Hercules, and Lacrosse.

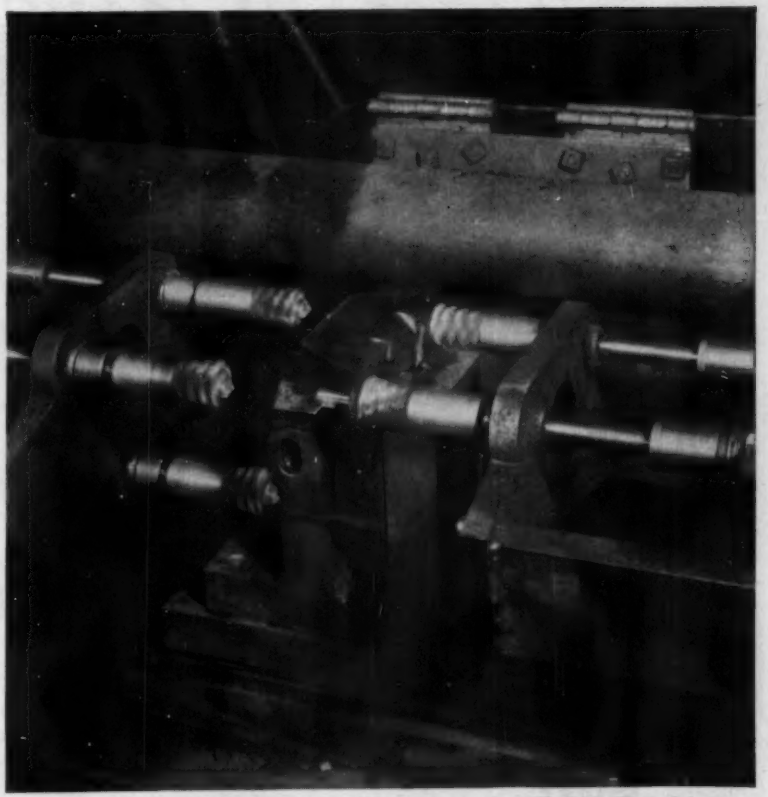
National Science Foundation Grant To Powder Metallurgy Conference

Sum of $3000 has been granted by NSF, Washington, for support of an international powder metallurgy conference to take place in New York June 13-17. Conference is the first of its kind to be held in the US and is being jointly sponsored by the Metal Powder Industries Federation and the Metallurgical Society of AIME. Grant was awarded as a means of fostering on an international level the exchange of scientific and engineering information relative to powder metallurgy.

It'll consist of three days of technical sessions followed by two days of plant visits. Papers will be read on the fundamentals and theory of powder metallurgy; dispersion strengthening; technology and methods; and powder metallurgy alloys,

"I'd like to work here—I've seen Acme in cartoons for years!"

FACING...*another problem*



SPOT FACING operation at Monarch Rubber Company, Hartville, Ohio. These Osborn End Brushes—in combination with drills—are horizontally mounted in two drill clusters. They clean surplus rubber from bolt holes and face the area around bolt holes on both sides of this rubber-bonded-to-steel motor mount. Rate: 750 pieces per hour.

SOLVED *with Osborn power brushing*

Facing off surplus rubber inside and around the bolt holes of this shock-absorbing, rubber-bonded-to-steel motor mount used to be a production bottleneck for this manufacturer.

Now an efficient combination setup of drills and Osborn Power Brushes replaces a former slow, costly drill press operation. Production is up to 6,000 pieces per 8-hour shift with brush life running 18,000 to 20,000 parts.

Your own troublesome metal finishing problems of every description—deburring, cleaning, polishing, precision blending—can be eliminated with advanced Osborn power brushing methods. An **O**sborn **B**rushing **A**nalysis—made in your plant now at no cost or obligation—is the first step toward smoother, less costly production. Write for details. *The Osborn Manufacturing Company, Dept.* C-98, *Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes
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Field Report . . .

materials, and application. Further information can be obtained from Metal Powder Industries Federation, 60 East 42nd St, New York 17, NY.

MEMOS

by BESS RITTER

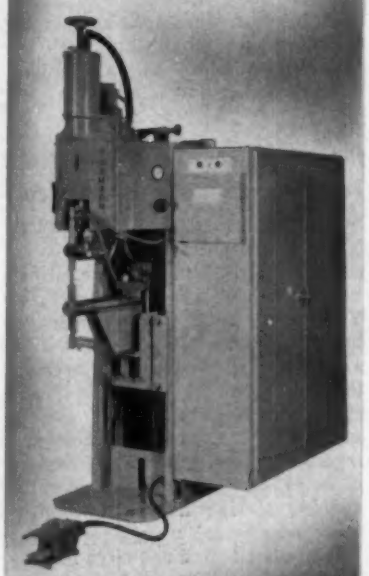
The first man who ever shoed a horse and (incidentally) was the first to found metals such as brass, iron and steel from the ore, was named Clement and lived in England up until the year 900 AD, according to myth. He was personally crowned King of all Trades by Alfred himself, and before he died on November 23rd, he had also become the bishop of Rome.

An even greater honor was awarded to him after death, for all Englishmen who worked with heavy metals elected him their Saint, and made his day a very personal trade holiday which was actively celebrated up until the mid-nineteenth century.

Not so long ago it was believed in some parts of England that the metal hinges of old coffins dug out of old graveyards were precious things if they were removed and remolded into finger rings. These could prevent persons from contracting rheumatism, or cure them if they already suffered from this ailment. All that was necessary was to wear the ring on the finger.

Such rings could also prevent and cure sufferers from the cramp, and according to some observers, elderly residents of sections of Lancashire and Somerset still wear plain metal "cramp rings" today for medicinal reasons. Some are plain, unadorned metal. Others are made of galvanized metal. Still others consist of two individual hoops, which are soldered together. One hoop is zinc. The other is copper.

The finest RESISTANCE *Welders* — *competitively priced!*



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PROJECTION	**FLASH-BUTT**
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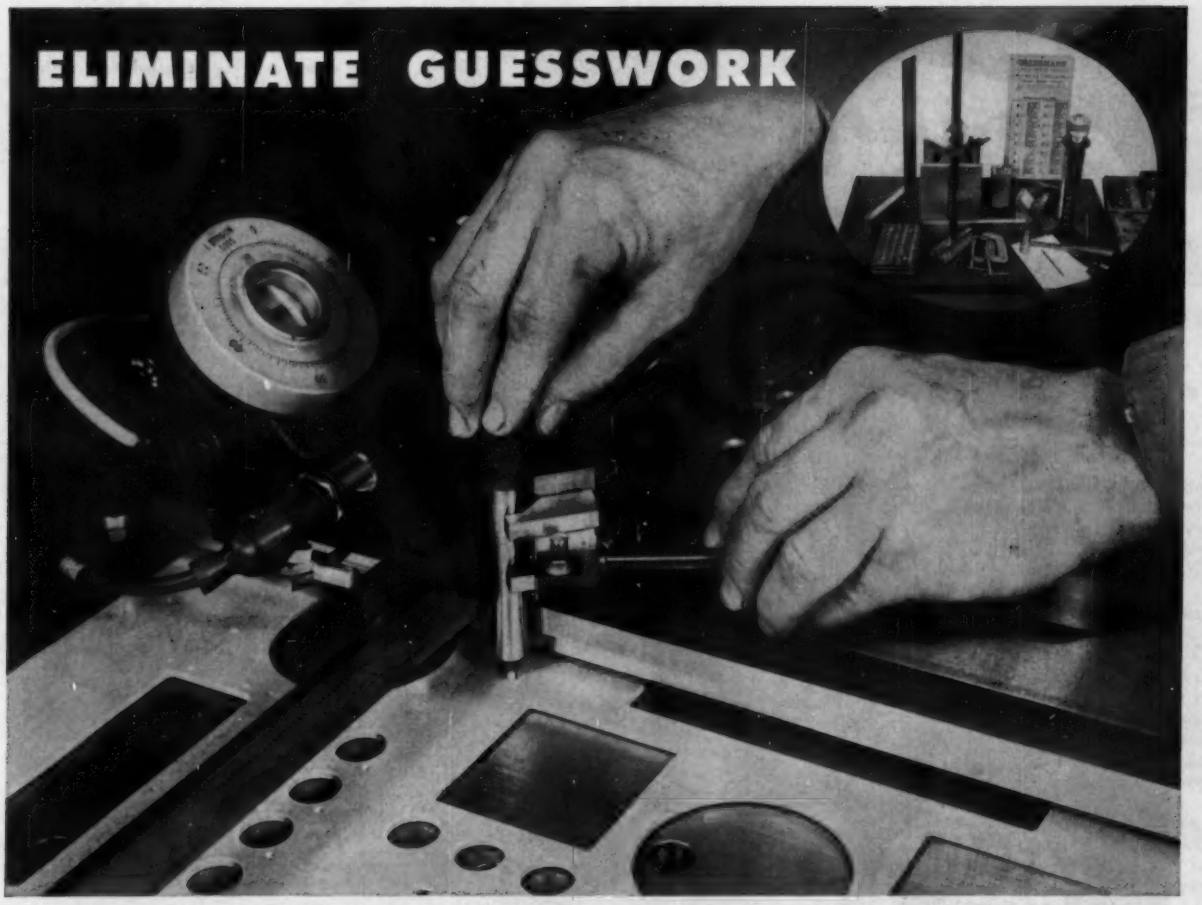

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Hole locations in templates and other flat work are read accurately at the rate of 1 to 3 holes per minute to ±.001" with the Wiedemann Inspector.

Both X and Y coordinates are read directly at the same setting with precision optical scanners. Work up to 36" x 42" is positioned *once* on the table against fixed locating strips. The exact location of each hole is read optically as soon as the stylus is positioned as shown above.

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For flat work
to 36" x 42" x ¼"

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MACHINES AND ATTACHMENTS

1 HYDRAULIC MILLING MACHINE —*Kent-Owens Machine Co, 955 Wall St, Toledo 10, Ohio.* 8-page illustrated bulletin provides technical information on the No. 3-36 for conventional and climb milling. Features include automatic hydraulic table feed, table working surface of 64 x 16 in. with 36-in. travel, and fully automatic cycle. Table has infinitely adjustable feed rate of ½ to 60 ipm and rapid traverse rate of 300 ipm in either direction.

2 SPECIAL HYDRAULIC PRESSES —*St Lawrence Hydraulic Co, 22043 Van Born Rd, Taylor, Mich.* 8-page brochure illustrates and describes 14 different types of presses and machines including special designs for assembly of electric motor stators and rotors varying in sizes up to 150 tons capacity; a 150-ton forming press engineered to form abrasive cutoff wheels; and other specially designed units for the plastic and automotive industries.

3 PRECISION SURFACE GRINDERS —*Covel Manufacturing Co, Benton Harbor, Mich.* 4-page bulletin 860-1 pictures and gives data on Compact line of units from 6 x 12 to 10 x 16-in. capacity in both hand and power feed models. Also included is the new 6A cutter and tool grinder featuring a swiveling head that tilts 15° either side of center for quick and simple clearance angle adjustments.

4 DOUBLE CRANK PRESSES — *Cleveland Punch & Shear Works Co, 3917 St Clair Ave, Cleveland 14, Ohio.* 8-page catalog SD2-60 gives details on line of straight sided mechanical power presses that feature welded steel construction and new streamlined design. Includes chart listing standard and extra features available.

5 ESSENTIALS OF ROTARY GEAR SHAVING—*National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich.* 18-page reference manual (5-60-1B) contains basic gear production and gear shaving information. Line drawings and photos illustrate principles and considerations. Application table aids in selecting shaving machines for both external and internal gears.

"I've called you all in here because I think I'm worth more money—so how about working harder so I can get it?"

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Fabricator Reduces Punching Costs by Changing to Omega Tool Steel

This picture, taken at Dave Steel Co., Asheville, N. C., shows Bethlehem Omega tool steel punching a ½-in. diam hole in a structural angle about ⅜-in. thick. The fabricator reported that the Omega performed as though the structural steel were so much butter. It produced thousands of clean, burr-free holes of uniform size, resulting in an 18 pct reduction in punching costs, as compared with the grade formerly used.

Omega is our "super" grade of oil-hardening, shock-resisting tool steel. In addition to being a long-wearing grade, Omega offers maximum shock-resistance for hardnesses up to Rockwell C-59.

Omega tool steel can be quenched in oil at 1625 F. It also offers the advantage of water quenching from 1550 F.

TYPICAL ANALYSIS

C	Mn	Si	Mo	V
0.60	0.70	1.85	0.45	0.20

Besides its use in punches, Omega is also ideal for calking tools, beading tools, shear blades and chipping chisels—in fact, any severe service involving drastic and repeated impact.

If you would like full details on Omega tool steel, get in touch with your Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Pack Hardening Tools? Be Sure to Use a Thermocouple

When pack hardening tools to reduce scaling and decarburization, it's a good idea to place a thermocouple in the pack, against the tools, to check accurately the time the tools are at heat. Failure to do so may lead to trouble.

For example, an experienced heat-treater pack hardened a large-diameter die ring made of Bethlehem Lehigh H tool steel. Then he checked the hardness. Imagine his surprise to find it was only Rockwell C-48. Puzzled, he checked the furnace pyrometer charts. They showed that the recommended heating cycle had been followed. But why such a low hardness?

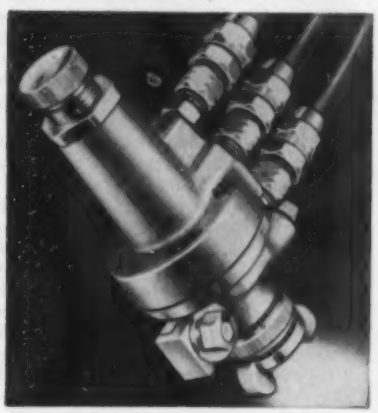
A Bethlehem contact metallurgist suggested that the die ring be rehardened, and that a thermocouple be inserted in the pack against the ring. After this was done, and the cycle repeated, the hardness jumped to Rockwell C-60. It was noted that the time required to heat the tool was 50 pct greater than in the first cycle. Thus the heat-treater had proof that in the initial treatment, the die ring was not heated long enough to reach proper temperature, despite the fact that the furnace pyrometer apparently indicated the correct heating cycle.

Upset-forged Discs Are Easy To Machine

Bethlehem upset-forged discs, made of Cromo-WV (H-12) tool steel, are ideal for aluminum extrusions tooling because of the basic 5 pct chrome analysis. They are also economical because of their easy machinability, and ease of heat-treatment. They're made with exacting care, and are finished in ring dies to insure good section and sharp edges. Moreover, Cromo-WV has good resistance to washing and heat checking.

Spray lubrication cuts metal-forming costs

Another benefit of DeVilbiss total service



DeVilbiss WDB automatic spray guns are specially designed for cycled or continuous application of lubricants and coolants during metal-forming and machining operations. Durable WDB guns are adjustable for spray-pattern size, shape, and fluid volume. Fully automatic or manually operated control valves provide up to 60 spray cycles per minute. Contact your nearest DeVilbiss representative or write: The DeVilbiss Company, Toledo 1, Ohio.

FOR TOTAL SERVICE, CALL

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6 HIGH SPEED SHEETING LINES —*F J Littell Machine Co, Automation Division, 4101 N Ravenswood Ave, Chicago 13, Ill.* 12-page bulletin G-10 gives details on line with capacity to handle steel stock as thick as 0.020 in. down to 0.0055-in. tinplate. Accuracy is indicated by its guaranteed ability to hold tolerances of 0.007 in. on length and squareness at speeds of up to 75 three-foot blanks per minute. Operation is completely automatic.

7 UNIVERSAL MACHINE—*Wisconsin Drill Head Co, 4986 N 124th St, Butler, Wis.* 4-page bulletin 560 illustrates and describes the Wis-Matic which performs a variety of drilling, tapping, boring, reaming, and spot-facing operations on as many as five sides of a part in one work cycle. Design features covered; specifications and dimensions included.

8 THREAD ROLLING HEADS—*Landis Machine Co, Waynesboro, Pa.* 6-page bulletin F-99-3 which covers in detail the No. 5 and No. 7 thread roll heads, illustrates and describes the No. 3½ thread rolling head which has a NC and NF range from 7/16 to ¼ in. Design and operating features and specifications included.

9 CUTOFF MACHINES—*Modern Machine Tool Co, Jackson, Mich.* 4-page bulletin 1g Mo contains information on automatic units that cut off, chamfer, groove, and form tubing and bar stock in a single operation. Gives production rates for cutting solid bar stock and tubing. Cuts bar stock up to 3 in. OD and tubing up to 8 in. in diameter. Also covers hot spinning machines which cut, close, and weld one end of the piece.

10 PIERCING, NOTCHING, AND BLANKING PRESSES—*Federal Machine & Welder Co, Warren, Ohio.* 16-page bulletin 52200 illustrates and describes the WARCO line in capacities from 100 to 800 tons.

11 EXPLOSIVE FORMING — *Propellex Chemical Division, Chromalloy Corp, Box 187, Edwardsville, Ill.* 4-page technical bulletin No. 4 describes the Explosiform process, a method of shaping metal parts by means of explosive energy. In addition to background information,

"The plant's shut down so that program is on tape."

Reduce small parts handling costs!

Built to handle a wide variety of parts—sizes and shapes—the OBE's versatility and rugged design make it a valuable asset in integrating and automating production line operations. Even and continuous flow is provided. Costly and tedious manual operations are eliminated.

Special Features Include:

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- Automatic feed controls and special orientation devices available. Right- or left-hand discharge to suit your needs.
- Rugged construction — standard components.
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Write for complete details on the new RCA Orienting Belt Elevator. Also ask about RCA's full line of automatic feeding equipment.

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"408 precision washers, in one chuck load, now surface ground in same time as 20 by former method . . . substantial savings on all other Blanchard-ground jobs . . . finished work quality outstanding . . . former sub-contracted jobs now done at less cost in our own shop . . . operator fatigue practically eliminated . . . maintenance is very low."
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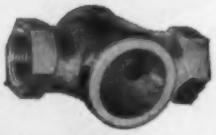
AUTOMATIC CHUCKING MACHINES

perform one to three operations in sequence or simultaneously . . .

TO CUT PRODUCTION COSTS...

More completely finished parts at the end of the day with no partly finished pieces lying around is the regular accomplishment of Goss & DeLeeuw "1-2-3" chuckers. It means complete finishing on one, two or three ends simultaneously or in sequence without tool resetting, rechucking or parts handling. Machining operations may include boring, facing, turning and threading.

Change over from job to job is simple. Cost-cutting is assured on long or short runs. Goss and DeLeeuw Chucking Machines are the only standard machines of their type which operate the "1-2-3" way to reduce costs per piece and step up the number of pieces per hour.



Investigate the opportunities offered by these machines on your production by sending samples of your work for time and cost estimates—Ask for illustrated descriptive literature.

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advantages and applications are listed as well as materials and products for which the process has been perfected. Section discusses five ways in which the Division works with the fabricator to develop the forming method best suited for his purpose.

12 "CUT-MACHINING"—*Wallace Supplies Mfg Co, 1304 West Diversey, Chicago 14, Ill.* 28-page catalog describes and illustrates process in which both cut ends of metal rods, angles, channels, I-beams, and solid bar stock are cut clean with circular abrasive saws, eliminating secondary operations in many instances. Line includes modular, combination cutting and deburring, swing type, Rotator, Roll-A-Round, and a complete line of bandsaw machines.

TOOLS AND ACCESSORIES

13 THREADING TOOL — *National Acme Co, Threading Tools Division, 170 E 131st St, Cleveland 8, Ohio.* 8-page illustrated bulletin DV-1 covers application of the new 5-chaser Vers-O-Tool, available in a wide range of sizes. Evaluation of use of this tool as it relates to producing threads on pieces having flats, keyways, slots, for drilled holes is outlined. Specifications and data are given for ordering the tool for either revolving or non-revolving spindles.

14 DEEP HOLE DRILLS — *Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn.* 4-page circular 638 3-60-5B presents illustrated data on drills for critical jobs. Solid carbide or carbide-tipped drill tips operate at speeds of 8000 rpm and higher. Irregular pieces, very large pieces, and high-strength, high-temp alloys can be drilled to diameter tolerances within a few ten-thousandths of an inch with minimum drift; secondary hole-sizing operations are eliminated.

15 CUTTING OILS—*Eastern Machine Screw Corp, Truman & Barclay Sts, New Haven 6, Conn.* 4-page H & G Cutting Oil Chart is compiled as an aid to help select the proper grade of cutting lubricant for various materials; it presents the recommendations of all of the leading oil companies.

"But boss—only yesterday you bawled me out for being a clock-watcher."

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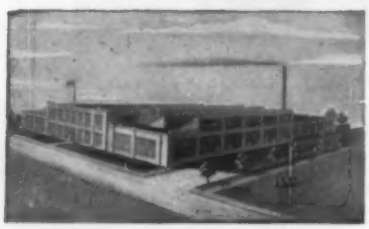

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16 OPTICAL COMPARATORS—*Jones & Lamson Machine Co, Springfield, Vt.* 22-page booklet (form LO-5921) tells what the comparator is, what it does, and how it does it. Examples of functions illustrated and described; applications discussed.

17 "GAGING SHORTCUTS" — *Hi-Precision Grinding Inc, 939 Baker St, Costa Mesa, Calif.* 4-page booklet pictures and explains new approaches to gaging problems. Shows suggested uses of Deltronic Tenth Plug gage kits and Precision Micro-Ball gage kits. Information given is applicable to most other types of gages. Methods of shortcutting tedious production and inspection jobs illustrated.

18 THERMOCOUPLE ASSEMBLIES—*Minneapolis-Honeywell Regulator Co, Wayne and Windrim Aves, Philadelphia 44, Pa.* 40-page catalog G100-1 describes over 100 complete thermocouple assemblies in detail including specifications, dimensions, photos, new lower prices, and ordering information.

19 AUTOMATIC RECESSING TOOL—*Madison Industries Inc, PO Box 1137, Providence, RI.* Brochure provides data on tool that cuts recesses to exact depth, width, and position in one operation. It will complete a recessing job in 3 to 7 seconds.

20 INTERNAL SPLINE GAGE—*Comtor Co, Waltham 54, Mass.* Bulletin 50 describes features and applications of Comtorplug expanding plug gage equipped for between-pins gaging of internal splines and gears as quickly and easily as gaging plain round holes.

21 PRESSURE AND TEMPERATURE RECORDERS—*US Gauge Division of American Machine & Metals Inc, Sellersville, Pa.* 8-page catalog 800 illustrates and describes design and construction features of these instruments. Pressure and temperature elements discussed; specifications and dimensions included.

22 CARBIDE GRADES — *Wesson Co, 1220 Woodward Heights Blvd, Ferndale 20, Mich.* 4-page Technical Data Paper 60-1WM describes various grades of Wessonmetal cemented straight-tungsten and compound carbides. Table indicates

"What this one needs is an operator with more moving parts."

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because Motor Burnouts are slowing production

...3-Phase Motors with built-in KLIXON PROTECTORS

- ***Permit Maximum Motor Output***
- ***Reduce Costly Down Time***
- ***Eliminate Motor Burnouts***

Will the life of your 3-phase motors equal that of the equipment in which they are installed . . . or will they burn out causing unnecessary down time and costly production delays?

You can be sure of full motor life by specifying on your equipment and replacement motor purchase order, "these motors to include KLIXON Protectors."

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KLIXON-Protected Motors are now available from your motor supplier. Specify and use motors with KLIXON Inherent Overheat Protectors. The savings obtained more than offset the slight additional cost.

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CIRCLE 289 READER SERVICE CARD

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This shop cuts costs by using STANICUT Oil 137

Machines seven metals, one plastic with this one cutting fluid

Shank Manufacturing Company, Chicago, cuts production costs three ways by using STANICUT Oil 137 BCS. (1) The 15 Warner & Swasey Lathes are never down for change of cutting fluid when the metal being worked is changed. There's no time lost with shutting down, cleaning up and changing oil. (2) There are no losses from the use of the wrong cutting fluid. (3) Floor space is used for productive machinery instead of being tied up as storage space for barrels of different cutting fluids.

Titanium, brass, alloy steel, aluminum and seven grades of Stainless plus Teflon plastic are all worked on the machines. Latest equipment, a reputation for good work, experienced operators and on-time delivery keep business coming to Shank. STANICUT Oil 137 BCS helps Shank hold down manufacturing costs.

Does cutting costs with a cutting fluid interest you? Let one of Standard Oil's experienced lubrication specialists show you how STANICUT Oil 137 BCS can do it. Call the Standard Oil office nearest you in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

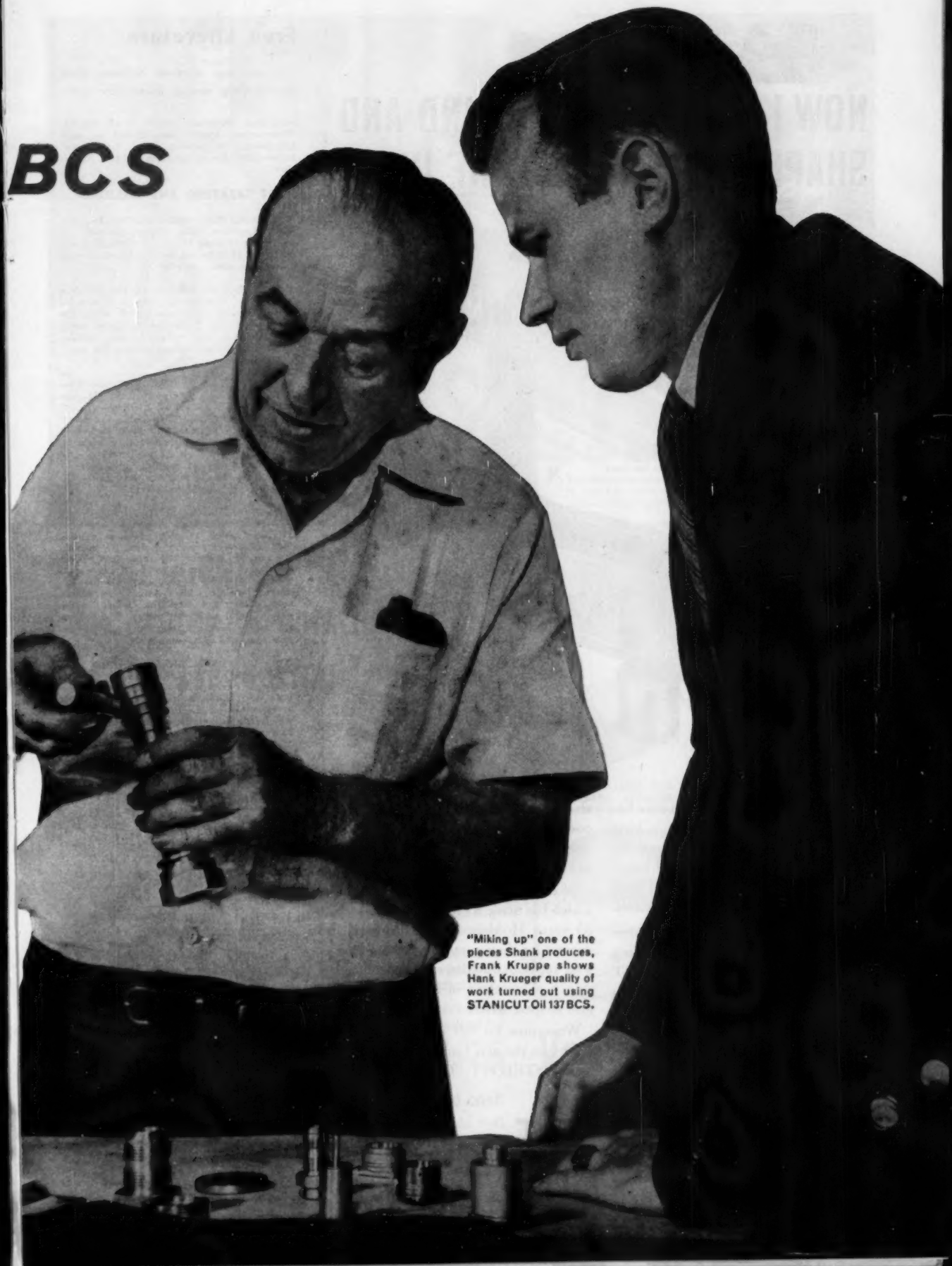
Commercially pure AMS 4921 Titanium oxygen injector nozzle gets an inspection from Frank Kruppe, Shank president (right), and Standard Oil's Henry Krueger. Hank Krueger provides Shank plant with technical service on cutting fluids and lubrication. Hank has the experience for this work. He's been doing it for six years. He has an engineering degree from Illinois Institute of Technology and has completed the Standard Oil Sales Engineering School course.

Quick facts about STANICUT OIL 137 BCS

- Has excellent extreme pressure properties. Ideal for low machinability steels.
- Has medium-low viscosity. Low enough for rapid, cooling flow. High enough to avoid "fogging".
- Non-corrosive to aluminum, *titanium* and all steels, tools and machines.
- Sterile, non-irritating and non-toxic.
- Suitable for many operations—tapping, threading, drilling, gear shaving, broaching, etc. Gives excellent tool life.

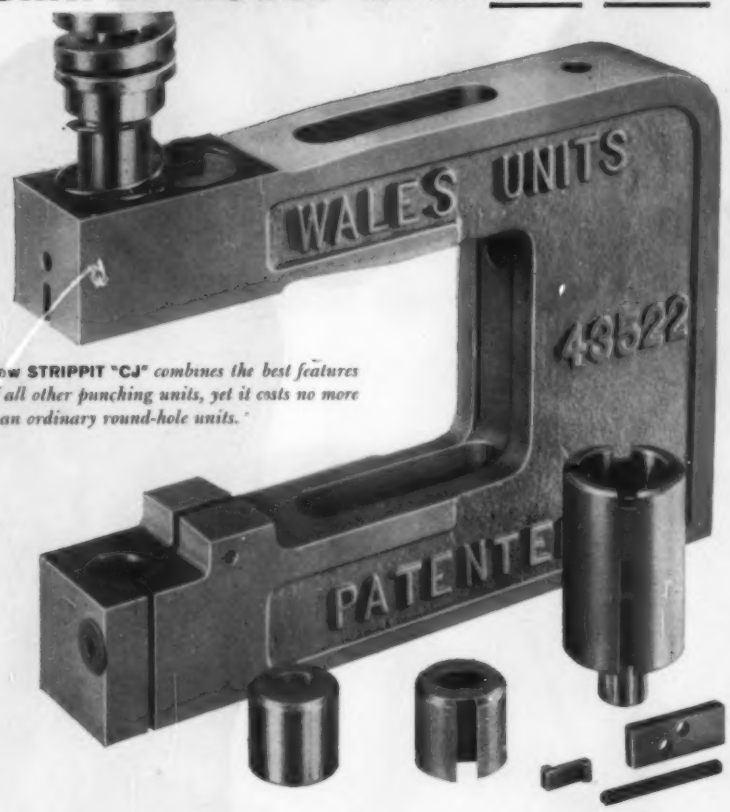
You expect more from STANDARD *and you get it!*

BCS



"Miking up" one of the pieces Shank produces, Frank Kruppe shows Hank Krueger quality of work turned out using STANICUT Oil 137 BCS.

NOW! PUNCH BOTH ROUND AND SHAPED HOLES WITH ONE UNIT



New STRIPPIT "CJ" *combines the best features of all other punching units, yet it costs no more than ordinary round-hole units.*

Here's greater versatility than ever before in a self-contained hole punching unit. STRIPPIT "CJ" holders and die bases are keyed to take shaped parts. And you pay no more for the "CJ" unit than any competitive round hole unit.

If your current metalworking requirements call for round holes in anything up to ¼" mild steel, the STRIPPIT "CJ" fills the bill. But let's say you get a future job that requires obround, square or rectangular holes. Simply substitute the proper shaped punches, punch guides and die buttons. They're always in stock. You save the cost of a complete new unit or the inconvenience of returning your existing unit to the factory for keying.

Of course you get the same quality which has made STRIPPIT famous for 35 years. Holders are metallurgically correct for their punching range. And a far superior one piece shoulder head punch is standard in both the round and shaped series.

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◄ CIRCLE 291 READER SERVICE CARD

Free Literature

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workpiece materials, types of operations, Wessonmetal grades that should be used and ranges of cutting speed that should be specified for optimum machining operations.

HEAT TREATING AND WELDING

23 WELDERS—*Miller Electric Mfg Co, Appleton, Wis.* 12-page booklet, "A Full Line of Fine Welders," illustrates and describes 40 different models together with accessories and controls.

24 ELECTRODES—*Arcair Co, PO Box 431, Lancaster, Ohio.* Literature covers special electrodes used with the Arcair process. Lists the different types available for use with Arcair torches, and recommended current setting for welding machine.

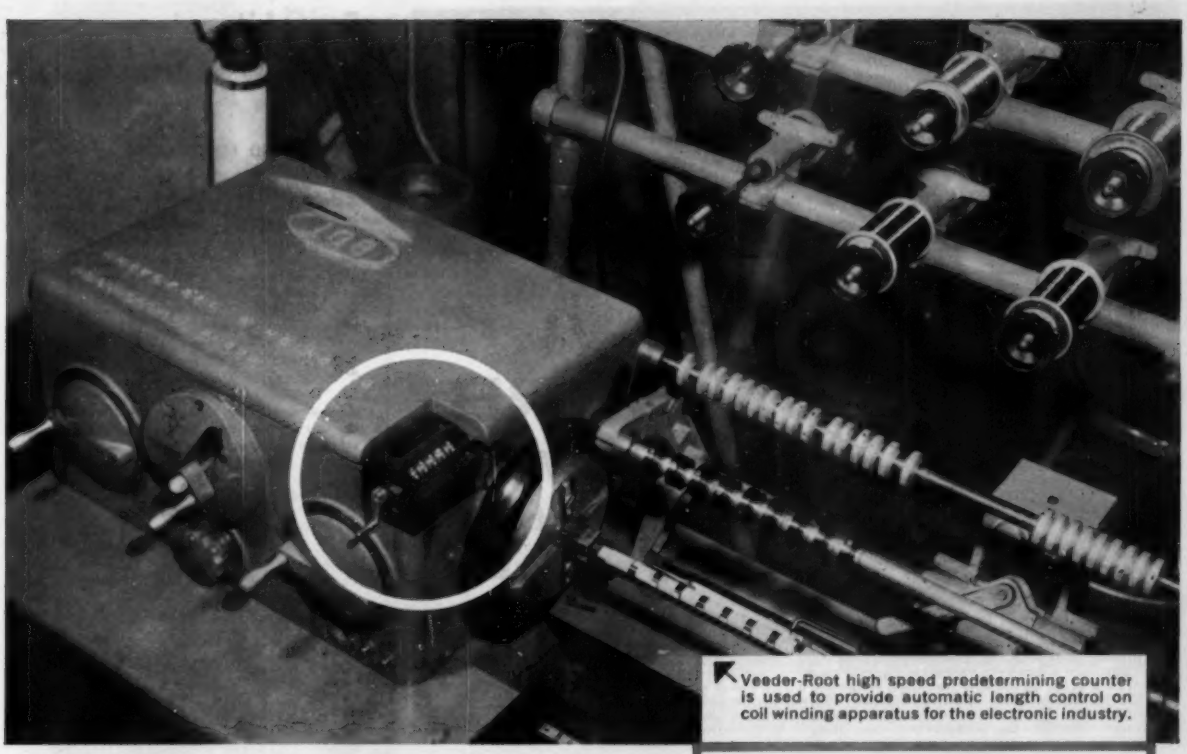
25 RESISTANCE WELDS—*Taylor-Winfield Corp, Warren, Ohio.* 24-page bulletin SP-18 contains pictures of 268 welded products and 20 photos of welders. Case histories demonstrate how resistance welding machines are selected or specially engineered for needs of particular welded products. Types of welding are shown—spot, seam, projection, arc, flash-butt, upset-butt; also metal gathering.

26 RESISTANCE WELDING ALLOYS—*Air Reduction Sales Co, 150 E 42nd St, New York 17, NY.* 24-page catalog 1308 on Tuffaloy welding tips, tip holders, and alloys utilizes the new RW taper numbering system for specifying spot-welding tip size as proposed by the Resistance Welding Alloy Association. Shows new holders in straight, offset, close-coupled, and universal styles. Also covers bar stock, castings, forgings, welding accessories, and alloy standards.

27 PRINTED CIRCUIT BOARD SOLDERING SYSTEM—*Radio Corp of America, Industrial & Automation Division, Bldg 15-1, Camden, NJ.* Catalog A. 1090 gives details on the RCA automatic system which handles single-sided printed circuit boards in a wide range of sizes at speeds of up to 600 finished assemblies per hr. Requiring only one operator to load and unload the assemblies, the system applies the flux, preheats the board, solders the assembly, and cleans off excess flux.

"I could have sworn the man said that machine would do the work of three men."

CIRCLE 292 READER SERVICE CARD



Veeder-Root high speed predetermining counter is used to provide automatic length control on coil winding apparatus for the electronic industry.

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Accurate lineal measuring and recording can plug many of those hard-to-find loopholes in cost and production control.

The method . . . Veeder-Root Counters with modern on-the-spot indication, readout and automatic length control — stopping profit give-away from old-fashioned measuring!

- **Worm Driven Counters** . . . complete measuring unit using groove, plain faced, knurled or rubber faced friction wheels which revolve as material passes under them. Indication in yards, feet, meters or other units as required.
- **Count/Pak Measuring** . . . electric and electronic counters actuated by pulses through a photohead feeding into an electromagnetic counter. Ideal for non-contact measuring.
- **Mechanical Length Control** . . . predetermining counters actuate stop motions or signals when required lengths are reached. Control is automatic, measurement is exact.
- **Electronic Length Control** . . . high speed predetermining counters for non-contact measuring. Counters actuated by pulses through a photohead, easily engineered for special applications, 300,000 counts per minute and sequential stops of 10 or more can be provided.

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A Veeder-Root engineer will gladly survey your needs and recommend the specific type of counting device for accurate lineal measuring; or standard counters are available through your local Veeder-Root Distributor. Call or write today for complete information.

Lineal Measuring Counters can be used for

• Metal • Thread • Wire • Braid
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and all roll goods

Quick reset, high speed predetermining counters.

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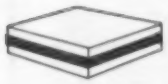
NEW! UNISORB "UL" Machine Mount ...for machines with built-in leveling screws

The new model "UL" Unisorb Level-Rite Mount has been developed specially for use under machines with their own leveling screws.

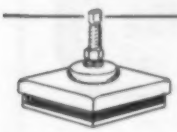
It combines a Unisorb vibration control pad with a cast steel base plate having a recessed center to accept the leveling screw. The Unisorb Level-Rite "UL" eliminates all need for anchor bolts or lag screws, and machines can be moved whenever needed. The Unisorb Pad reduces transmitted vibration up to 85%, allows higher machine speeds, cuts noise and lowers building maintenance.

Unisorb Level-Rite "UL" is available in a range of sizes and loadings, and with high or super density Unisorb — to meet all requirements. Ask about this mount — or any one of the other Unisorb Mounts — from your local distributor or write direct.



Unisorb Mounting Pads
Unisorb pads are the basic vibration control unit, identified by the red centers and brand mark. Available in a wide range of densities and thicknesses for proper application. Saves up to 80% in installation time and costs.

Unisorb Level-Rite 200
Unisorb Level-Rite "Junior" has been especially designed for light machines, air conditioners, business machines and similar equipment. A low cost, precision leveling device and vibration control unit, with loading limit of 200 lbs. per unit. Ideal for original equipment.



Unisorb Level-Rite Mount
Unisorb Level-Rite is a universal, self-contained leveling device for all types of machines. Fast, simplified way to achieve and hold precise level. Available with exclusive screw-post design or as a basic mounting plate for use with built-in leveling devices.

Remember — to simplify installation, improve performance and control vibration...

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PARTS AND MATERIALS

28 STAINLESS STEEL—*Republic Steel Corp, 1441 Republic Bldg, Cleveland 1, Ohio.* 40-page booklet Adv. 1124 covers chromium-nickel types, 300 series. Contains general information and technical data on corrosion resistance, fabricating and joining methods, care in fabricating and finishing, tables of mechanical and physical properties.

29 INSTRUMENT COMPONENTS — *Actuator Products Corp, 40 Nashua St, Woburn, Mass.* 12-page booklet describes and gives detailed specifications on the firm's Apcor lines of 12-speed instrument drives, geared adapters, tachometers, plus single and double gear-boxes. Flexible shaft and clutch assemblies also described.

30 BASIC CLUTCHES—*Formsprag Co, 23601 Hoover Rd, Warren, Mich.* 4-page condensed catalog FS-859 covers four basic series of general purpose clutches for indexing, backstopping, and over-running applications. Series covers a complete range of sizes and torque capacities from 50 lb-in. to 136,500 lb-ft; they range in size from 0.250-in. bore dia to 12 in.

31 INDUSTRIAL PLASTICS—*Polymer Corp of Pennsylvania, 2140 Fairmont Ave, Reading, Pa.* 12-page booklet covers Polypenco plastics. Contains property and application data on mill shapes of nylons, TFE fluorocarbons, polycarbonates, chlorinated polyethers and cross-linked polystyrene available. Information on Fluorosint, a new TFE base resin is included as well as data on nylon pressure hose and tubing.

32 STAINLESS ANALYSES SPECS CHART—*Peter A Frasse & Co, 17 Grand St, New York 13, NY.* 8-1/2 x 11-in. revised Data Chart, Sec A, No. 1, provides analyses specifications for 58 different types of stainless steel. Covers all 40 standard AISI grades plus 18 specials including precipitation hardening grades 17-4, 17-7, and 15-7 MO. Nearest corresponding SAE aid AMS designations are cross-indexed with AISI grades.

33 INDUCTION MOTORS — *General Electric Co, Schenectady 5, NY.* 14-page illustrated bulletin GEC-1049 contains information on Tri-Clad 55 motors, single and three-phase, from 3/4 to 150 hp. Ap-

"Burton . . . marry the girl . . . we'll give you a week with pay . . . let's get it over with and get some work done!!"

Dispenses all lubricating oils up to 25,000 SSUV at 100° F.

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ALEMITE OIL-MIST SYSTEM WITH thermo-aire

Now! Automatic Lubrication for:

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Heavy-duty slides and ways!

Largest size anti-friction bearings!

Now even your heavy-duty bearing surfaces can be lubricated continuously and automatically with the required high viscosity oils! An exclusive new "Thermo-Aire" feature on Alemite's Oil-Mist System preheats incoming air. This preheated air permits the atomization of the heaviest straight mineral oils.

The "Thermo-Aire" unit brings all the advantages of Alemite Oil-Mist to heavy-duty lubrication. You get automatic, continuous lubrication ... eliminate guesswork, cut oil consumption (up to 90%). You prevent product damage caused by oil drippings, extend bearing life, eliminate waste, save manhours, get greater safety, eliminate machine downtime and reduce the number of lubricants needed.

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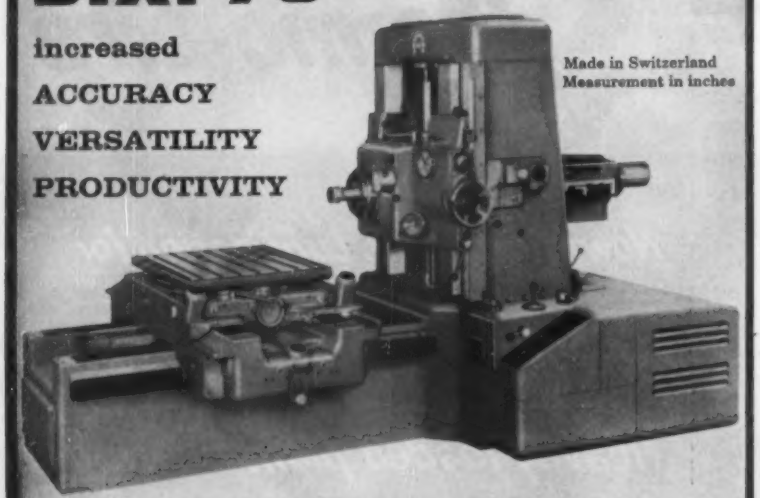

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Measurement in inches

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- Projected optical setting – direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
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MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York.—Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

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plication chart gives types recommended for various loads and ambient conditions. Tables give dimensions, prices, characteristics, and performance data, ordering instructions, modifications, and accessories.

34 ELECTRO-MECHANICAL CONTROL SYSTEM—*Seneca Falls Machine Co, Electronics Division, 13 Fyfe Bldg, Seneca Falls, NY.* 6-page catalog EE-1008 illustrates and describes systems and components for use on a wide variety of production machinery. Contains information on point-to-point control systems, speed control systems, and fractional and integral horsepower servo systems as well as system components. Typical application setups pictured.

35 STEPPING MOTOR—*Ledex Inc, 123 Webster St, Dayton 2, Ohio.* 4-page bulletin G-360-1 pictures and provides information on the Digimotor, a compact motor and indexing device. Features include exceptionally high reliability and high-torque-to-size ratio. Covers uni-directional and bi-directional models, with and without detent. Complete torque chart included.

36 PROMET BRONZE — *American Crucible Products Co, 1337 Oberlin Ave, Lorain, Ohio.* 16-page brochure includes general information and technical data on bearings, bushings, bar stock, and babbitt metal. In addition to describing Promet alloys, six pages cover specifications, chemical composition, and mechanical properties of brass and bronze casting alloys, and manganese and aluminum bronze alloys.

37 SNAP-LOCK LIMIT SWITCH — *Electrical Controls Division of National Acme Co, 170 E 131st St, Cleveland 8, Ohio.* 16-page illustrated bulletin EC-SL260 describes and pictures the new SL-2. Covers design features, functions, applications, specifications, parts lists, actuating cams, and operating levers.

38 NEW GEARING SYSTEM—*Illinois Tool Works, Spiroid Division, 2501 N Keeler Ave, Chicago 39, Ill.* 8-page booklet AD-68 presents data on Helicon gears that offer a high degree of insensitivity to mounting errors; gears are applicable through a ratio range from 3:1 to 400:1. Description of the gears and the system's relation to other types of face-gearing is included. Depending on materials, these gears can be made in a wide range of

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JOHN SHRAGG, Foreman of the Press Dept., Ekco Products Company

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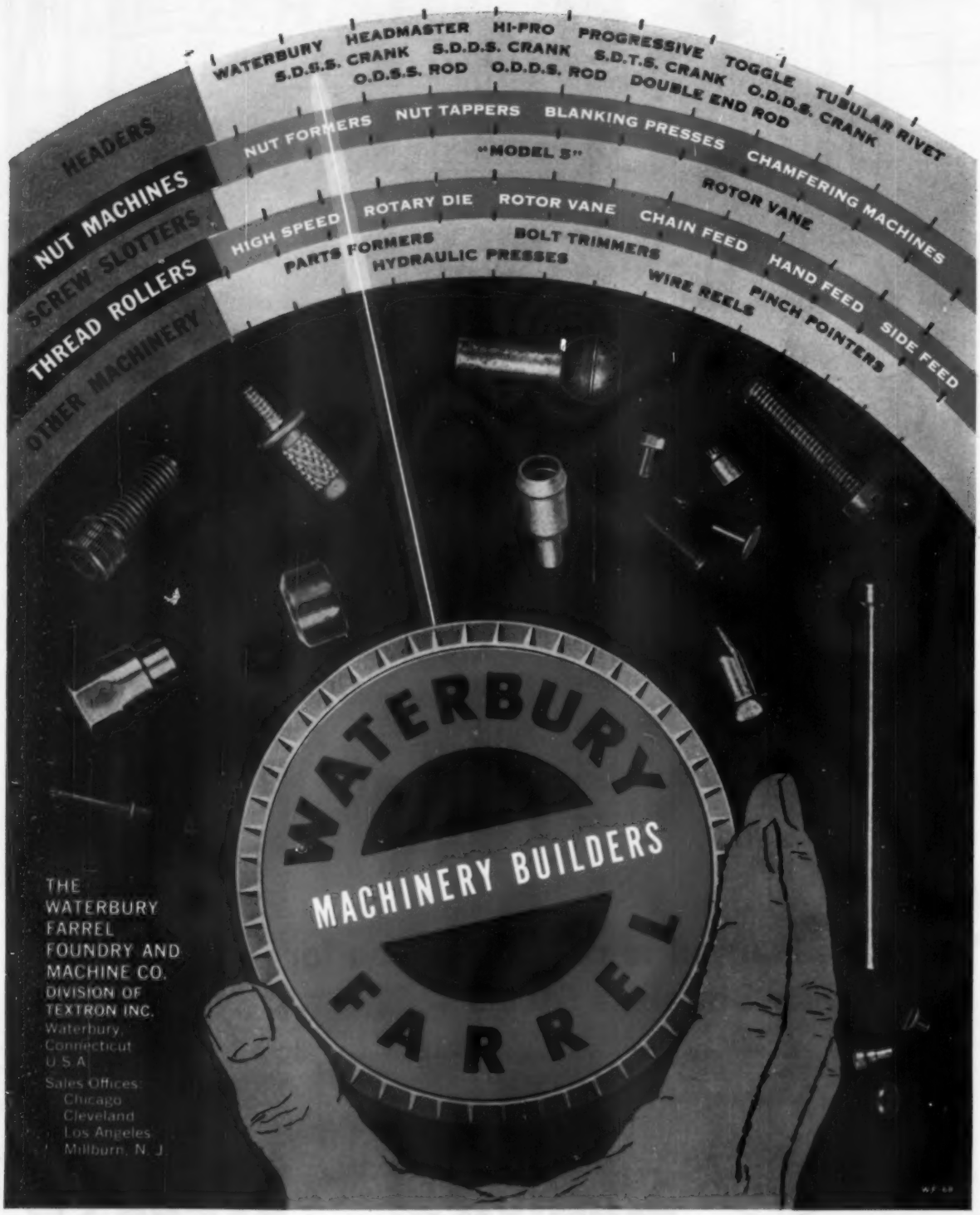
Select the Type and Size that fits your Purpose



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diameters for light or heavy loads, including hardened steel pinions and gears for power transmission.

39 EXTRUDED STAINLESS SHAPES —*H M Harper Co, 8200 Lehigh Ave, Morton Grove, Ill.* 16-page booklet includes photos of 38 different shapes the company has produced under the Ugine-Sejournet process. Standard tolerance and complete specifications on a wide range of metals regularly extruded, as well as a glossary of extruded shape terms included.

40 ALUMINUM MILL PRODUCTS—*Harvey Aluminum, 19200 S Western Ave, Torrance, Calif.* 12-page technical brochure reviews full range of shapes, sizes, and alloys available in primary aluminum pig, ingot, and billet and in wrought aluminum mill products. Metallurgical tables and design information included. Light and heavy press extrusions, press forgings, hand forgings, impact extrusions, pipe, tubing, and other commodities listed with product applications and alloy characteristics.

41 HOT WORK TOOL STEEL—*Uddeholm Co of America Inc, 155 E 44th St, New York 17, NY.* Illustrated booklet describes UHB Calmax, an air or oil hardening chromium-tungsten-cobalt steel especially recommended for hot pressing dies, mandrels, extrusion dies, die casting dies for copper, brass, and similar alloys with high melting temperatures wherever the highest hardness and wear resistance must be retained through elevated production temperatures. Discusses characteristics and uses, gives details on treatment in forging, annealing, stress relieving, hardening, and tempering.

42 MOTORS AND RELAYS—*Barber-Colman Co, Rockford, Ill.* 4-page Quick Reference File illustrates and gives typical specifications on complete line of ac and dc fractional horsepower motors, tachometer generators, and ultra sensitive relays. Lists rated hp, dimensions, special features, and typical applications. Motors are available in a variety of voltage ranges, styles, and specifications.

43 STAINLESS STEELS — *Vanadium Corp of America, 420 Lexington Ave, New York 17, NY.* Brochure covers the history of stainless steels from the experiments of Vauquelin, Stodart, and Faraday in the late 18th and early 19th centuries through the first large scale production of stainless steels in the US and in England, to the development of the stainless steels we use today. Includes a chronology of the development from 1797 to 1933.

"Simpson would like to ask for a raise."

"Get rid of that DUST!"

"The boss was sore and I was on the spot.

"He shoved the report from the efficiency engineer at me. I read it: 'Yearly loss due to machine wear, misalignment and down time . . . $3,000. Major cause . . . abrasive dust.'

"The boss pointed his finger at me, 'Get rid of that dust and get rid of it fast!' "

Now, it was my problem, and I was on the spot.

"First thing I did was to check into a central dust collecting system. But the lowest bid I could get was $8,000. Too much.

"Then I came across a Torit ad, offering economical portable dust collectors.

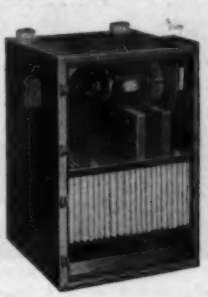
"Two days after my call Torit engineers showed me how in only one week they could install a portable, unitized Torit Dust Collector at each of our eight grinders, trapping dust right at its source—cleaning the air throughout the entire plant.

"Total cost? Only $2400.00. That's a $5,600.00 saving over the lowest priced central system.

"You guessed it—we installed the eight Torit Collectors."

Torit solved my problem

"This year when we received our report it read: 'Loss due to machine wear, misalignment and down time...$340.00.' A saving of $2,660.



"This time the boss was all smiles. He slapped me on the back, 'Charlie, you did a fine job getting rid of that dust. Frankly, I didn't think it could be done with such a small investment.'

"Now there's a pretty nice fellow to work for.

"If you've got a dust problem, or are about to have one, write the Torit people. They've manufactured and sold more dust collectors than anyone else in the U.S.A. Chances are they can help you the way they helped us."

TORIT manufacturing company

Dept. 411, 1133 Rankin St., St. Paul 16, Minn.

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For angular spacing jobs so precise you could never handle them before

NO. 2 ULTRA-PRECISE TABLE

Reads direct to 1 sec.

Total error in any position: 2 sec.

GUARANTEED POSITIONING ACCURACY FOR SHOP USE

All points in 90° increments, from zero to ± 1 sec.
All points in 18° increments, from zero to ± 1½ sec.
All points in 2° increments, from zero to ± 1¾ sec.
Worm accuracy—¼ sec.
Repetition of settings—½ sec.
Total error in any position—2 sec.
2 sec. = 0.00005" (½ tenth) on 10" dia.

Now...with this new No. 2 Moore Ultra-Precise 11-inch 2 sec. Rotary Table—you can provide the closest precision angular spacing needed today. It reads to 1 sec. and has an overall performance accuracy of ± 2 sec. throughout the entire 360°. It is being widely used in angular locations for guidance systems. A nondisengageable, thread-ground worm, combined with the accurately spaced teeth of its mating gear, makes this extreme precision possible. Loss of accuracy, due to repeated throwing in and out of the worm, is eliminated.

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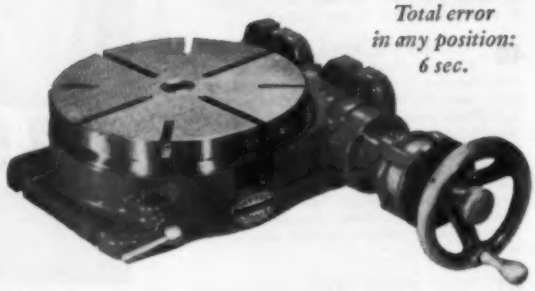

Total error in any position: 6 sec.

GUARANTEED POSITIONING ACCURACY FOR SHOP USE

All points in 90° increments, from zero, ± 1½ sec.
All points in 18° increments, from zero, ± 2 sec.
All points in 2° increments, from zero, ± 4 sec.
Worm accuracy—2 sec.
Repetition of settings—1 sec.
Total error in any position—6 sec.
6 sec. = .00015" (1½ tenths) on 10" dia.

This popular No. 2 Moore Precision 11-inch Rotary Table has an overall performance accuracy of ± 6 seconds throughout the entire 360°, and reads direct to 5 sec. It is being used successfully by leading companies on government-sponsored precision jobs never before accomplished. You can use this rotary table for countless precision spacing applications on jig borers and jig grinders.

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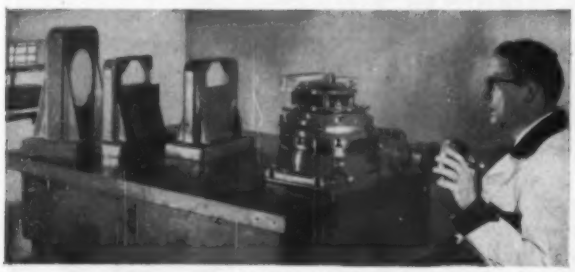
Write today for descriptive literature about the Moore 2 sec. Ultra-Precise *and 6 sec.* Precision *Rotary Tables.*



Accuracy assured by interferometric inspection and calibration, the first time industry has used light-wave measuring methods for precise division of the circle.

These rotary tables are accurate in either horizontal or vertical position. Further applications are possible by using the table in conjunction with its companion unit, Model No. 2 Sine Plate.

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Clearing Division, US Industries Inc, New York, has elected **John R Bartizal** president. He had been associated with the company for ten years when he resigned in 1954 as executive vice president to accept the post of board chairman and president of Benjamin Electric Manufacturing Co, Des Plaines, Ill

National Automatic Tool Co, Richmond, Ind, has appointed **Eugene Makie** vice president, manufacturing. Formerly general manufacturing manager of Curtiss-Wright Corp's Utica Division, he replaces **A B McCrea** who has been named vice president, finance

National Twist Drill & Tool Co, Rochester, Mich, has elected **William L Lukens** vice president and assistant to the president. Mr Lukens has been associated with the firm for 24 years

NAMES IN THE NEWS...

General Motors Corp has appointed **Frank O Riley** general manager of the Ternstedt Division, Detroit manufacturer of automobile hardware. Formerly director of engineering and sales, he succeeds the late **Leo R Schreiner.**

Lockheed Aircraft has named **Burt C Monesmith** corporate vice president, manufacturing, a newly established position for company-wide guidance on production functions. Appointed to succeed Mr Monesmith as vice president and general manager of the company's California Division in Burbank is **M Carl Haddon.** Mr Haddon previously served as Lockheed vice president and general manager of the Electronics and Avionics Division which is being integrated into the Lockheed Electronics Co as the Avionics and Industrial Products Division in Los Angeles.

Syntron Co, Homer City, Pa, has elected **Byron K Hartman** president to succeed **Carl C Weyandt,** one of the founders of the firm, who has retired. Mr Hartman joined the company, which is a subsidiary of Link-Belt Co, as executive vice president and general manager in 1959.

Allis-Chalmers Manufacturing Co, Milwaukee, has elected **J D Greensward** president of **Canadian Allis-Chalmers Ltd,** a wholly owned A-C subsidiary. He succeeds **Harold M Schudt** who has been named director of manufacturing, **Allis-Chalmers International.** Mr Greensward, who has been director of manufacturing, Industries Group, has been a vice president of the organization since 1952.

Hyster Co, Portland, Ore, has named **James L Woodley** head of company-wide manufacturing activities. He has been manager of the Danville, Ill, plant for the past five years.

Timken Roller Bearing Co, Canton, Ohio, has elected **W R Timken** president to succeed **D A Bessmer** who has resigned because of illness. Mr Timken has been acting president of the company since March and prior to that time was a vice president

Pratt & Whitney Co, West Hartford, Conn, has promoted **Edward E Kirkham** from chief development engineer to chief engineer of the machinery engineering department. He has been instrumental in the development of the company's numerically controlled machine tools and inspection machines

Acar Machine & Tool Co, Roseville, Mich, producer of special machines, tools and dies, jigs and fixtures, has appointed **George Cameron** vice president, general manager. Mr Cameron joins Acar after serving as director of engineering at Colonial Broach & Machine Co, Detroit

For smoother, easier drawing and forming

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Oakite DRAW CLEAN "M" cuts forming rejects, lengthens tool and die life, washes off fast

New Oakite Draw Clean "M" lubricant smoothes the way for lower reject rates on drawing and forming steel, aluminum, copper and brass. How? Draw Clean "M" clings to metal with such tenacity that pressures of 40 thousand psi cannot wipe it off. Even the thinnest film will prevent seizure that causes build-up, galling and scratching.

The components of Draw Clean "M" are soluble and, at annealing temperatures volatile. This is important to you because while it clings where most other compounds wipe away—it can be removed easily in a mild detergent solution. Yet the residue, if allowed to remain, is not harmful to metal or man.

By diluting with water in ratios as high as 1 to 9 Oakite Draw Clean "M" offers astonishing per-unit cost savings. It extends die life three times the previous experience. Miscible with both water and oil it may be adapted to any of the following:

light stamping	stretch forming	spinning
deep drawing	tube bending	punching
cold heading	tapping	wet grinding

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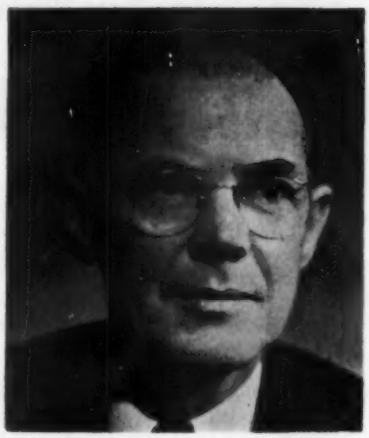
NAMES IN THE NEWS...



Gisholt Machine Co, Madison, Wis, has elected **Harvey A Waddell** (top) a vice president. He will continue to serve as treasurer and a board member in addition to his new duties. **Robert H Bruce,** general sales manager, has been named vice president, sales

Ford Motor Co has named **Raymond J Fitzgerald** manager of the production control department at the Buffalo stamping plant. Mr Fitzgerald, who came to Buffalo from Dearborn last August as superintendent of material control, has been with the organization since 1955. He succeeds **Robert E Bowen** who has been appointed manager of production programming and control in the Metal Stamping Division at Dearborn.

Verson Manufacturing Co, Dallas producer of tools and dies, has named **C J Kelleher** president. Formerly executive vice president, Mr Kelleher fills the post left vacant by the death of **John Verson** early this year.

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to Bring Down Milling Costs!

No. 1-14. 32" x 9" table . . . 14" table travel . . . hydraulic table feed . . . full automatic cycle.

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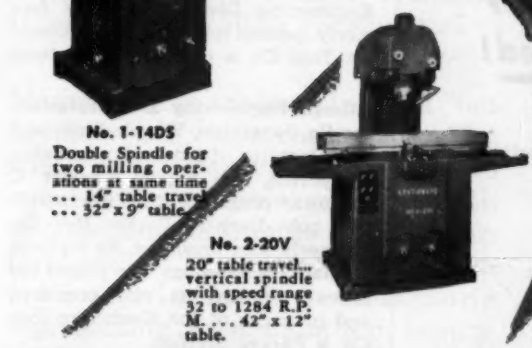

No. 2-20V 20" table travel . . . vertical spindle with speed range 32 to 1284 R.P.M. . . . 42" x 12" table.

No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

No. 3-36 . . . 36" table travel . . . 64" x 16" table . . . full automatic hydraulic feed.

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Put the work on Kent-Owens Machines for top-speed milling and topmost accuracy to keep your costs at a minimum! Advanced features throughout make the difference . . . greater dependability . . . accuracy maintained. Twin-post head mounting assures balanced load. Greater cutting efficiency—only two gear contacts, motor to spindle. Write for bulletin #757 on wide range of hydraulic and hand-operated machines. Let us quote on proper machine complete with tooling for your operation. Also, call on Kent-Owens for special machines. Kent-Owens Machine Co., Toledo, Ohio.

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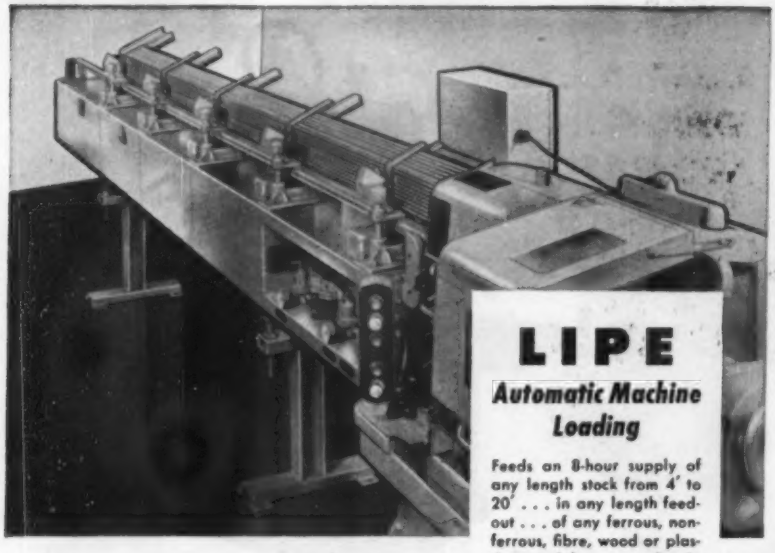
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Feeds an 8-hour supply of any length stock from 4' to 20' . . . in any length feed-out . . . of any ferrous, non-ferrous, fibre, wood or plastic material . . . ranging in diameter from 1/16" to 1 1/2".

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of bars, rods, tubing in practically every shape used!

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PIONEERS IN PNEUMATIC BAR-FEEDING

NAMES IN THE NEWS...

American Welding Society has elected **R D Thomas Jr**, president of **Arcos Corp**, Philadelphia, president of the Society for 1960-1961. **J H Blankenbuehler**, design engineer at **Hobart Brothers**, Troy, Ohio, has been elected a vice president of the Society, as was **Clarence E Jackson**, associate manager of electric welding development for **Linde Co Development Laboratories**, Newark, NJ.

Punch Products Corp, Buffalo manufacturer of unitized hole punching and notching equipment, has appointed **Rocco L Stefano** general manager and **Ralph L Wisbeck** sales manager.

Waukesha Motor Co has promoted **Harold O Schultz** to the post of machine shop superintendent. He was formerly general foreman of Shop Five.

Pioneer Engineering & Manufacturing Co, Detroit, has appointed **Richard A Green** vice president and general manager of the Industrial Engineering Division. He was formerly general manager of the Douglas Tool Co, a division of Pioneer.

Gilman Engineering & Manufacturing Co, Janesville, Wis, designer and manufacturer of automatic assembly equipment, has named **Chester C Holloway** president of the firm which is a subsidiary of Parker Pen Co. Formerly vice president, he replaces **William C Cummings** who joined the parent company as vice president and manager of the Eversharp Pen Co, a Parker division.

Commercial Filters Corp, Melrose, Mass, has elected **Frank W Welling** executive vice president. Mr Welling was formerly vice president of W A Case & Son Manufacturing Corp, Buffalo.

OBITUARIES

Daniel F Ahlberg, 62, executive engineer and export manager of **Michigan Tool Co**, Detroit, died April 19.

R E Brooks, 77, co-founder of **Cleaver-Brooks Co**, Milwaukee, and a pioneer in establishing the packaged boiler industry, died recently in Milwaukee. Mr Brooks served as president of the company from 1931 until 1943 and since that time has been board chairman.

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an important new development for quality control measurement

AMES MODEL AG7

Accu-Flow* Air Gage Recorder

A permanent record of continuous measurements can be made in magnifications of 1750 to 1—3500 to 1—and 17,500 to 1.

Measurements are recorded by a "hot needle" on 2"-wide chart paper. The width of the paper may be made to equal measurements as small as a tenth of one-thousandth or as wide as four-thousandths. This allows the reproduction of minimum graduations representing two millionths or twenty millionths of an inch.

The AG7 provides a completely impersonal measurement record that can be used both as a controlling device and as a means of furnishing visible "proof of precision" to buyers of the measured products. Send for free ACCU-FLOW FOLDER.

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ASTE Tool Show
Detroit, April 21-28

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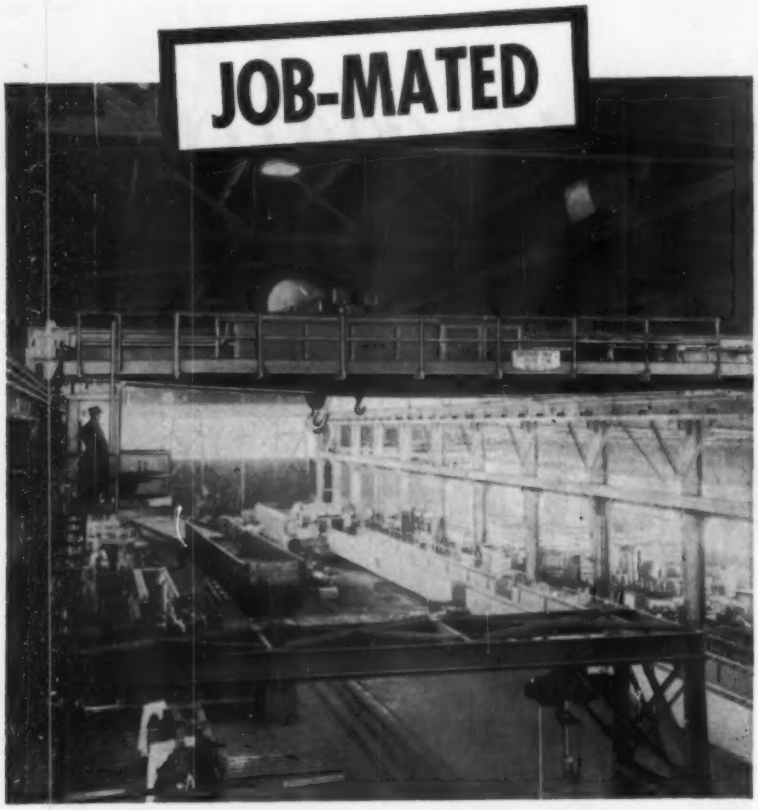

Make room for PROFITS

Effective production and storage space is increased . . . lifting, conveying and stacking are done more quickly and cheaply, with fewer men . . . and re-handling is eliminated—when your plant is equipped with a rugged, dependable, **"Job-Mated"** crane by Shepard Niles.

Shepard Niles Cranes are supplied with the exact combination of capacity, clearance, speed and controls you need to assure more efficient and profitable plant operation. Whichever one best meets your precise job conditions, it will be built to the same high quality standards that have made Shepard Niles America's largest, most relied upon, manufacturer of hoists and cranes.

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NEW BOOKS...

TIN AND ITS ALLOYS. *Edited by Ernest S Hedges. Published by St Martin's Press Inc, 175 5th Ave, New York 10, NY. 432 pages, 7½ x 10. Price $27.50.*

Written by a group of five members of the Tin Research Institute, each a specialist in his own field, and two of whom are university professors of metallurgy, this expertly prepared book covers virtually the entire field of tin and its applications.

The first chapter forms a general introduction and covers the history of the metal, its uses, and the scope of the tin industry. Chapter II deals with the application of tin and pewter, processing and care, and such varied uses as foil, pipe, collapsible tubes, and even tombs. The next two chapters are concerned with physical metallurgy and chemical behavior, while chapters V, VI, and VII discuss respectively electrodeposition, hot tinning, and tinplate. Remaining chapters deal with bearing alloys, die-casting alloys, solders, and bronzes—*HEL.*

BUILDING YOUR OWN TOOLS—*By Walter L Mierzwa, instructor, tool and die courses, Prosser Vocational High School, Chicago, Ill, Booklet 18 pages, 11 x 8½. Price $1.00.*

This is a do-it-yourself booklet which describes how to construct 12 different tools essential to the tool and die maker. It should be especially helpful to apprentices starting out in the trade and to vocational students who plan to make tool, die, or instrument making their livelihood.

Each project is completely set forth with machining procedures and materials needed, and with drawings giving all dimensions. Some of the uses and applications are also given.

All are precision tools, and to name a few: there's a grinding vise, an angle plate, a height-gage attachment, magnetic and solid V-blocks, and a sine bar with riser block described, among others.

Copies of the booklet can be obtained by writing directly to the author at 7529 N. Odell Ave, Chicago 48, Ill.

MECHANICAL WORLD YEAR BOOK, *1960. Published by Emmott & Co Ltd, 31 King St W, Manchester 3, England. 608 pages, 6 x 4. Price 5/- (70¢).*

Apart from some minor corrections and rearrangement, and a 7¢ increase in price, this year's issue ap-

A ROOMFUL of THOMPSON GRINDERS

This is the eighth Thompson grinder recently installed at Jessop which grinds plates and sheets up to 60" × 96" in size.

Jessop precision ground flat stock which is used in gages, dies, verniers and other exacting products.

Pictured above are 4 Thompson Grinders in the Specialties Division of Jessop Steel Company, Washington, Pennsylvania. There are 4 more Thompsons which are not shown in the above photo. All these Thompson machines are grinding to the extremely accurate tolerances and fine RMS finishes that distinguish Jessop's precision ground flat stock.

There are excellent reasons for using 8 Thompsons on this essential production. Mr. Joseph Manfredi, who is responsible for the quality and production of this famous ground flat stock, says, **"We have recently installed our eighth Thompson grinder in this division. We have proven the top performance of these rugged machines for many years. They give us the extreme accuracy and precision we demand—day after day with a minimum of maintenance."**

You may not need 8 Thompson grinders in your operations but it will pay you well to investigate what just one Thompson machine can do toward saving time, improving your products and cutting your costs of manufacture.

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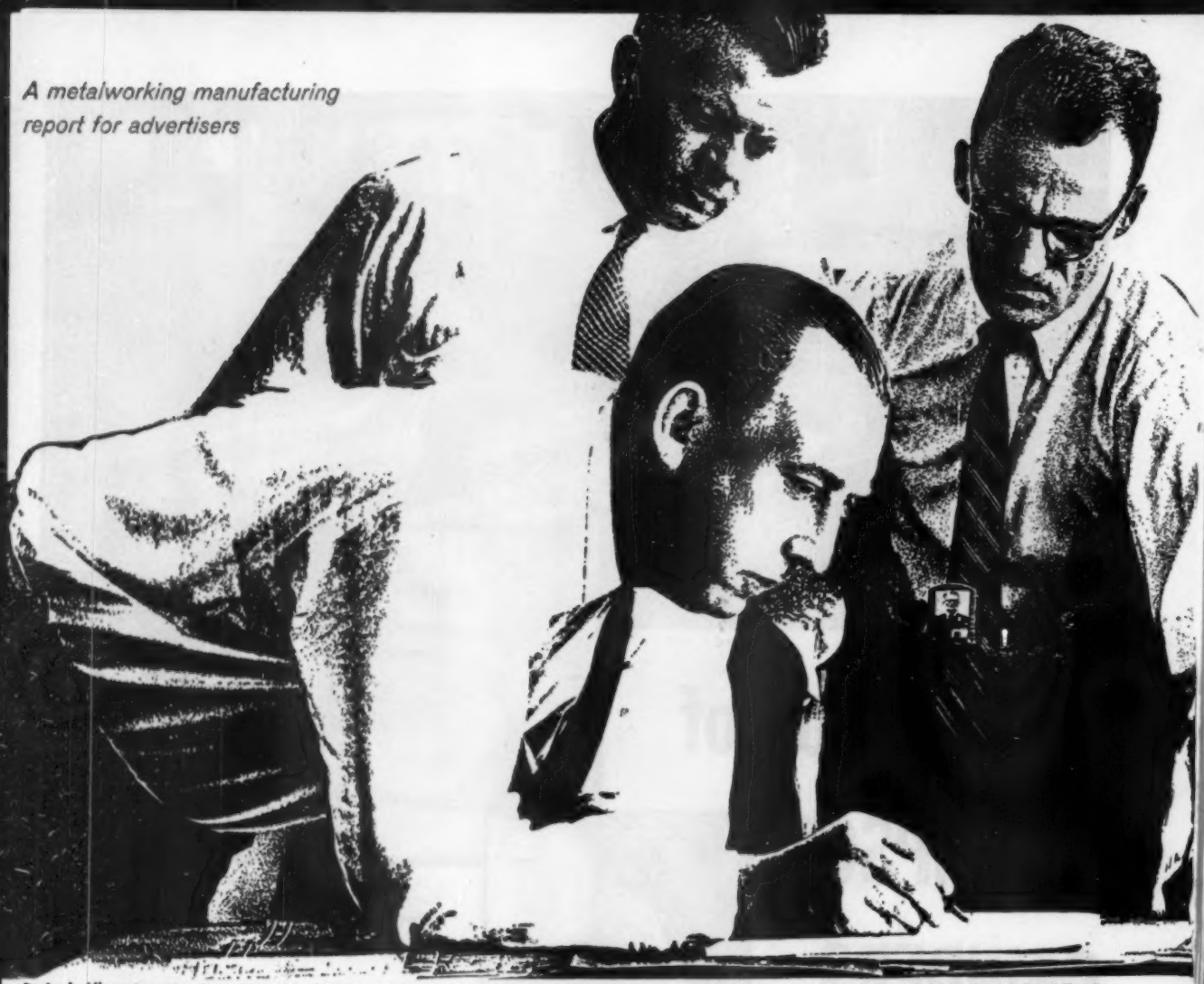
A metalworking manufacturing report for advertisers



Design huddle produces ideas for machine which "flows" a metal ring into a seamless compressor case. Standing, l. to r.—L. J. Dolin, superintendent, experimental sheet metal; Robert Knowlton,

Lighter, stronger, faster jet engines... constant challenge for

Pratt & Whitney Aircraft's manufacturing miracle men

Management team pioneers major breakthrough in metalworking manufacturing

Check-up—Bob Knowlton (l.), Stan Rusczik (r.) and operator Dominick Casasanta double check thickness of casing made on one of P&W's smaller flow turn machines.

New horizons—Production Engineer Edward Griswold, Bob Knowlton, Stan Rusczik and Lou Dolin confer on assembly of new machine capable of flow turning an 80" cylinder.

supervisor, advanced tool engineering; Stanley Ruszik, production engineer; and Robert C. Wright, chief, production engineering, for P & W—and, front, Claus L. Sporck, V.P., Lodge & Shipley Co.

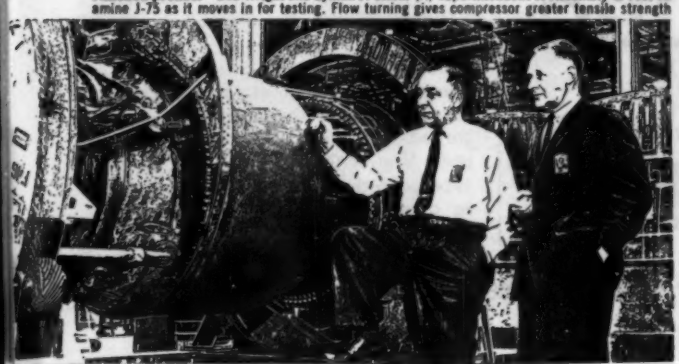
The difference between a 2-oz. jigger and a combustion chamber case for a 25,000-pound-thrust class J-75 jet engine is years of planning, imagination, engineering—and purest optimism. But it's typical of the manufacturing miracles that Pratt & Whitney Aircraft brings off as a matter of course.

The power plants for jet transports which now fly the Atlantic in 6½ hours are lighter, faster and stronger because a Norwegian engineer placed a 2-oz. jigger on the desk of the chief of advanced tool engineering at P&WA. The piece was unusual: seamless, even-walled, lightweight, finely-finished, and made on a machine that literally "flowed" a metal ring into cylindrical or conical shapes.

Here was an idea—if only it could be done on a large-enough scale. P&WA manufacturing men decided to give it a try. They teamed up with machine tool manufacturers Lodge & Shipley to produce the first flow turning machines in the U.S.—and the giants that are now turning out compressor cases and other highly stressed parts for P&WA jet engines.

The story of flow turning (*or shear forming as it is sometimes called*) has been told in detail in American Machinist/Metalworking Manufacturing. It's a story of the constant search for better ways to make things of metal. Our job is to keep manufacturing management men in metalworking posted on developments that will help solve manufacturing problems. More than 41,000 of them turn to AM/MM for just that kind of help. Here, then, is the ideal place to show how *your* product can help them!

Finished product—Bob Wright and Lyman J. Smith (r.) superintendent of Assembly & Test examine J-75 as it moves in for testing. Flow turning gives compressor greater tensile strength



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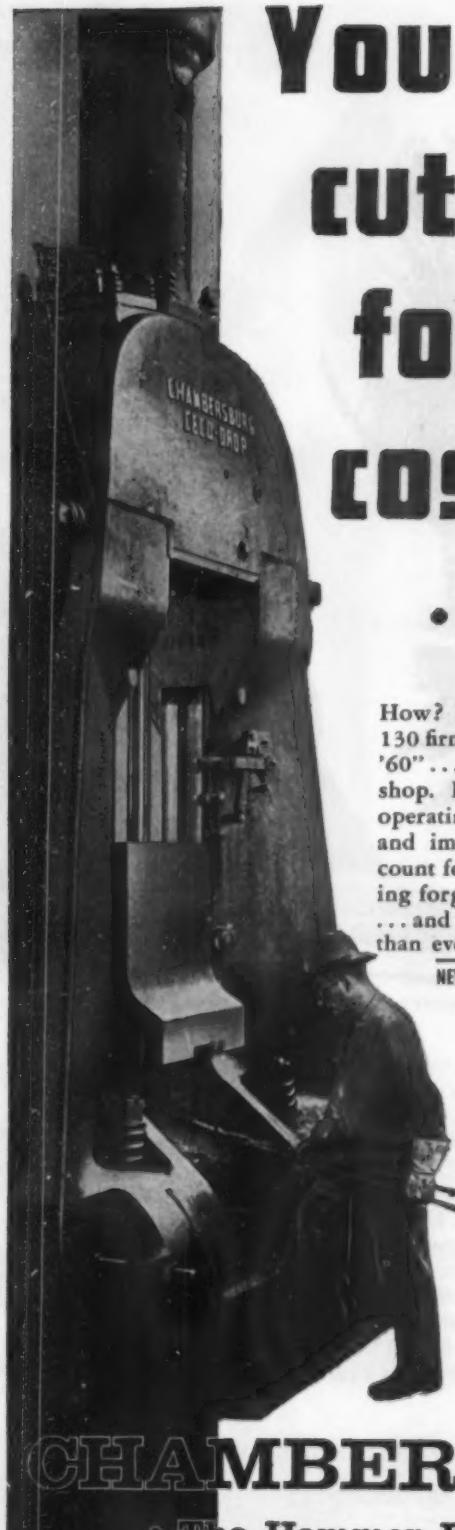

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How? By joining the more than 130 firms who are being "thrifty in '60" . . . install Ceco-Drops in your shop. Higher production, lower operating and maintenance cost, and improved safety features account for its endorsement by leading forge shops all over the world . . . and today's Ceco-Drop is better than ever!

NEW FEATURES ON TODAY'S CECO-DROPS

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DESIGNERS AND MANUFACTURERS OF THE IMPACTER

When it's a vital part, design it to be FORGED

pears to differ but little from the 1959 edition. Indeed, it suffers somewhat in the comparison in that the type shows signs of wear and lacks the clarity of last year's edition. This does not, however, detract from the usefulness of the book as a convenient, handy-size reference work for members of the engineering profession—*HEL.*

ELECTRICAL YEAR BOOK, *1960. Published by Emmott & Co Ltd, 31 King St W, Manchester 3, England. 407 pages, 6 x 4. Price 4/- (56¢).*

Like its companion work, the Mechanical World Year Book, this new edition appears to contain no new material and to vary in only minor detail from last year's edition. Electrical engineers, however, who do not own a copy of the preceding edition, will find it a useful pocketbook, filled with fundamental information on the electrical field—*HEL.*

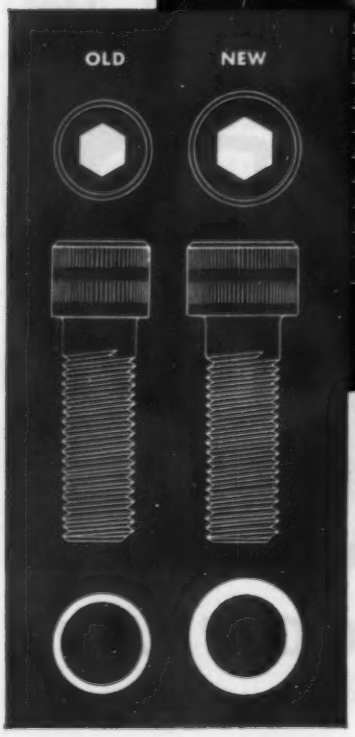
NEW FILMS...

STEEL BELT CONVEYORS. *Produced by Sandvik Steel Inc, 1702 Nevins Rd, Fair Lawn, NJ. 16mm, sound. Running time 30 min.*

Many of the uses for steel belt conveyors, including the handling of such diverse products as clay, chocolate, ice cream, coal, engine pistons, and human passengers, are illustrated in this new film. The belts are shown in warehousing, production, processing, shipping, receiving, sorting, and related operations. Also shown are many of the special applications for which steel belts are particularly well suited, such as conveying materials through high-temperature and low-temperature zones, plowing off bulk materials, and scraping off sticky materials. The ease with which the belts are cleaned is demonstrated, as well as their resistance to wear and abrasion.

SILVER THREADS AMASS THE GOLD. *Produced by Oster Mfg Co, 1340 E 289th St, Wickliffe, Ohio. 16mm, sound, color. Running time 25 min. No charge.*

Suitable for both vocational school students and for production personnel engaged in the cutting of pipe threads, this film features the complete line of Oster heavy-duty floor-type pipe threaders, and shows how to operate them for best performance.



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Send your bushing orders to Accurate. We'll keep you happy.

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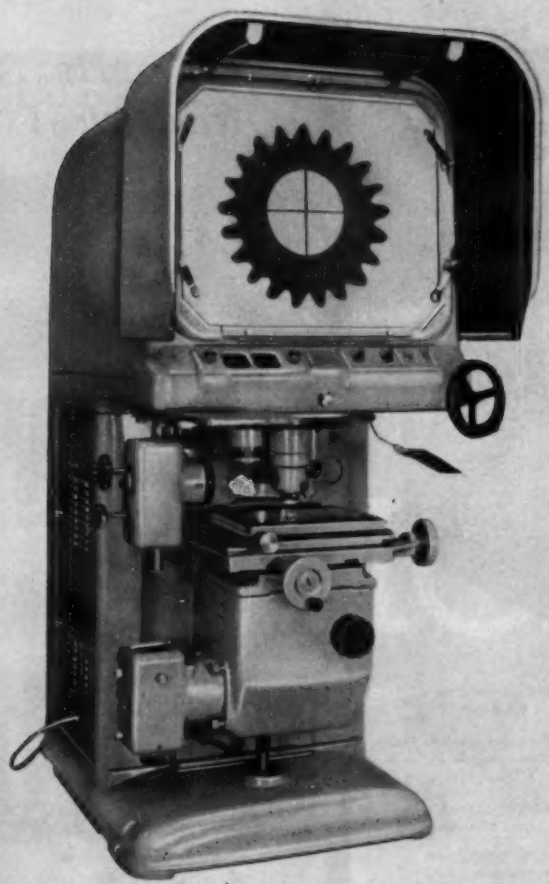

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the New Model 5A

NIKON OPTICAL COMPARATOR

with large screen
18 x 22 inches

A large-screen optical comparator may be no great innovation. But, when a large screen has the illumination brilliance which Nikon has brought to comparators; and the sharpness and edge-to-edge resolution which Nikon comparator lenses have demonstrated; this announcement begins to assume new importance.

The new Nikon 5A is probably the most advanced optical comparator in the field today. As in the case of other Nikon comparators, the 5A has facilities for surface as well as contour measurements and inspection. And for surface inspection, Nikon does not limit you to conventional oblique lighting. Nikon half-reflecting mirrors, available for each of the comparator lenses, provide vertical, shadowless surface illumination on the optical axis. The elimination of shadow permits greater accuracy in making surface measurements. This is further aided by the brilliance achieved in surface illumination because of the extreme speed or light transmission of Nikon lenses.

The Nikon 5A also features a 4-lens turret. A twist of the turret changes the magnification. And the image remains in exactly the same screen position for each lens.

Focusing with the 5A is completely effortless, and virtually automatic. Two instantly reversible motors drive the counterbalanced stage carriage —raising or lowering it, as required. The motion is smooth and steady. One motor provides the fast motion for coarse focusing, and the other operates the carriage for fine focusing. Cut-out micro-switches at the extreme travel limits of the carriage automatically shut off the motors.

A wide assortment of accessories is available: cross-moving and revolving micrometer stages of every conceivable design, including a stage with optical reading, also holding fixtures, protractor screens, charts and photo accessories.

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More power at the cutters

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It utilizes two motors, one for spindle drive; a separate motor for moving table, saddle and knee. Compare this and the other outstanding features of the new Greaves Mill. You'll see why Greaves is "The MOST Mill for the LEAST Money."

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- Wide range of speed/feed combinations for any type material, any type job.
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- New 7½ HP spindle drive motor, with separate motor for movable components, provides extra power for heavy milling.
- Easy-to-reach controls. Handwheels and vertical crank disengage automatically when not in use.
- New rapid traverse lever within operating control area.
- Separate drive motor for table, saddle and knee provides more smooth balanced power at the cutter.

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Gage Block Precision means
GRADE "A" ACCURACY*

with **ULTRA-CHEX GAGE BLOCKS** 82 PIECE SET...

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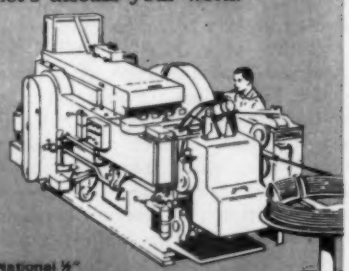

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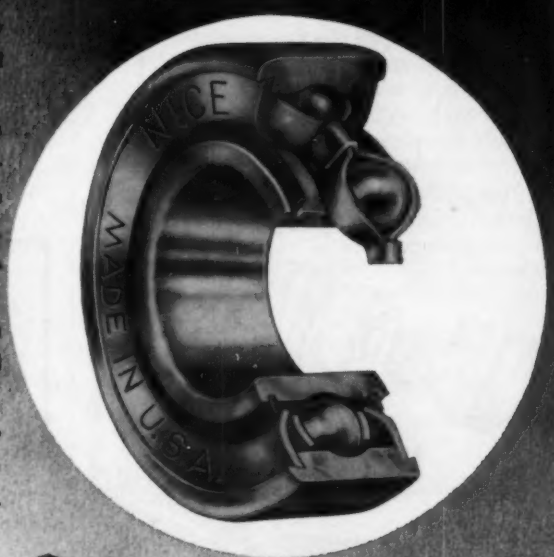

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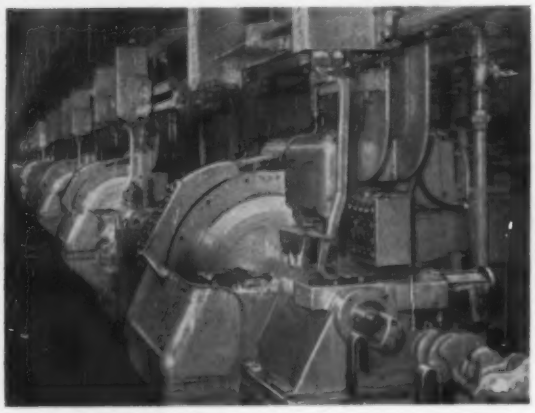

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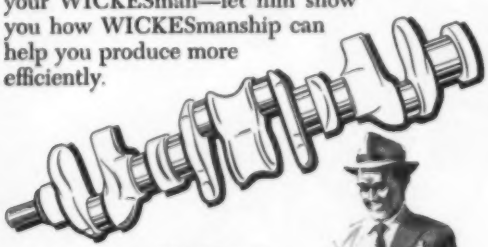

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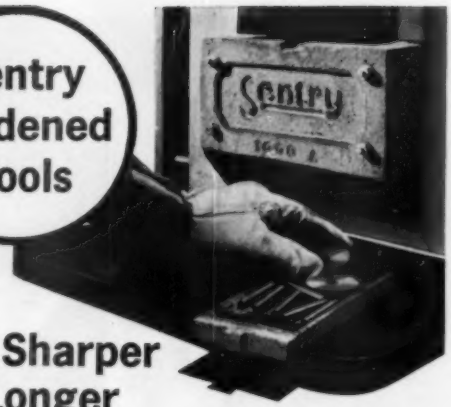

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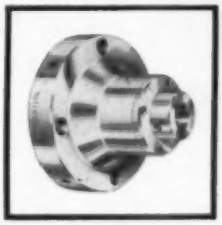

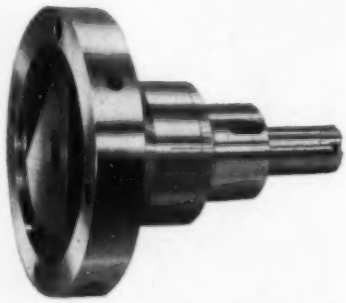

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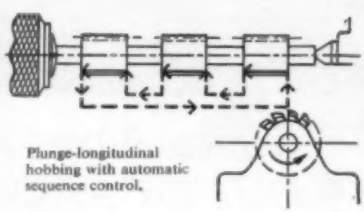
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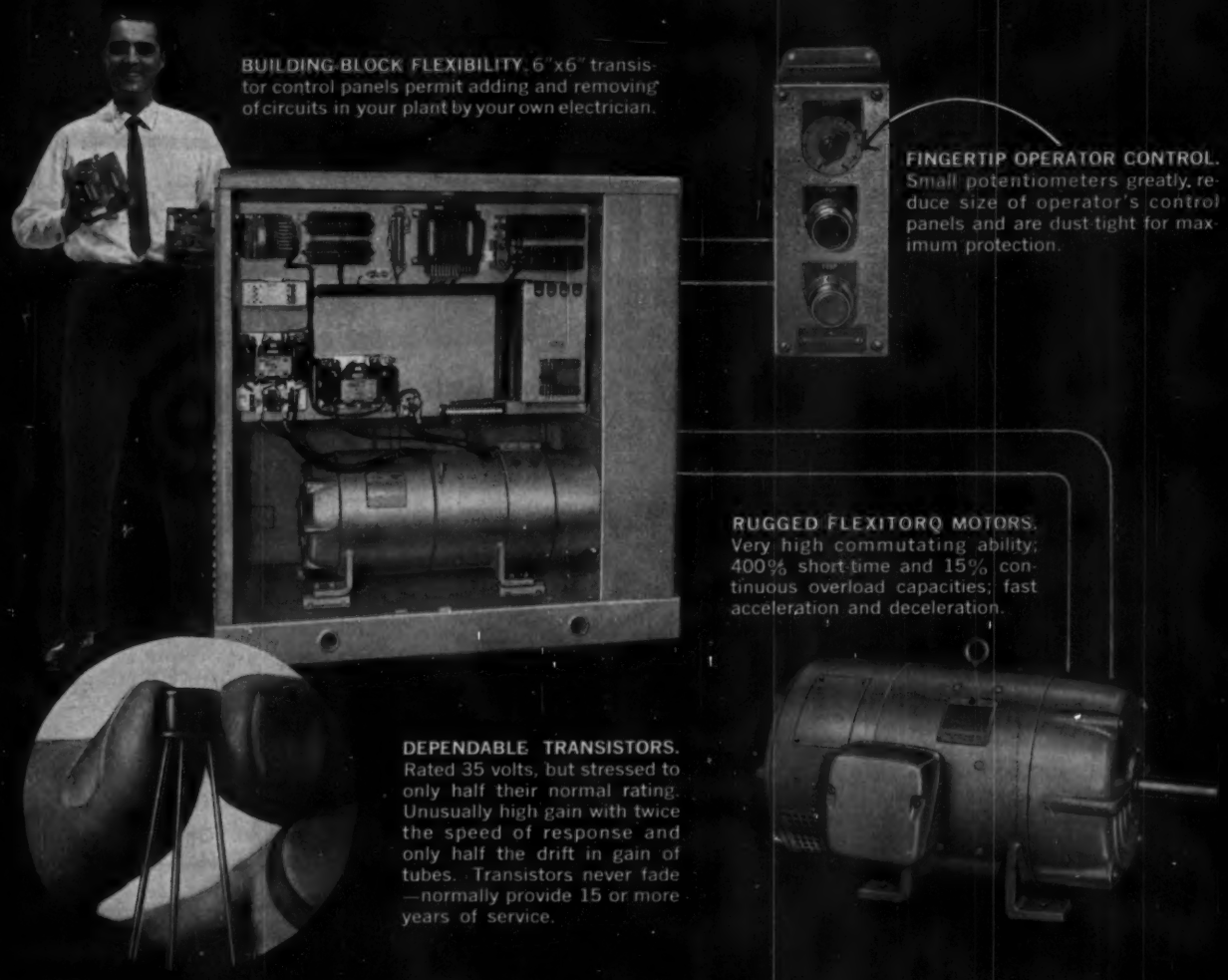
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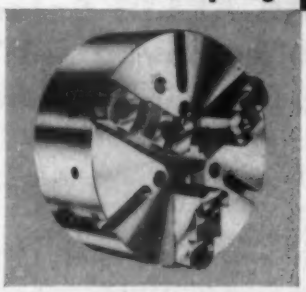

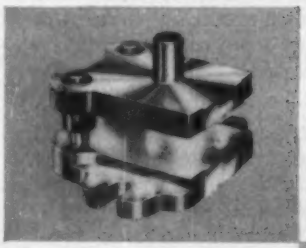

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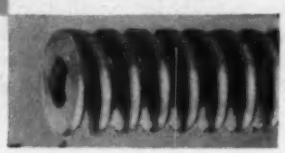

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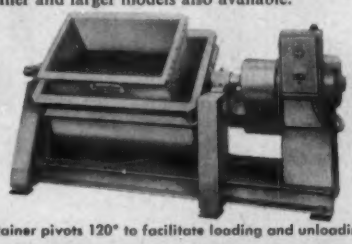

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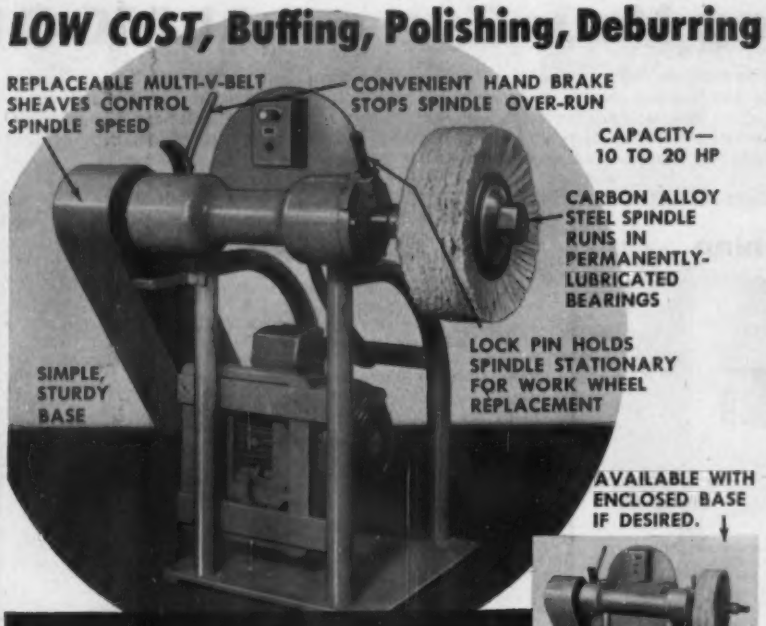
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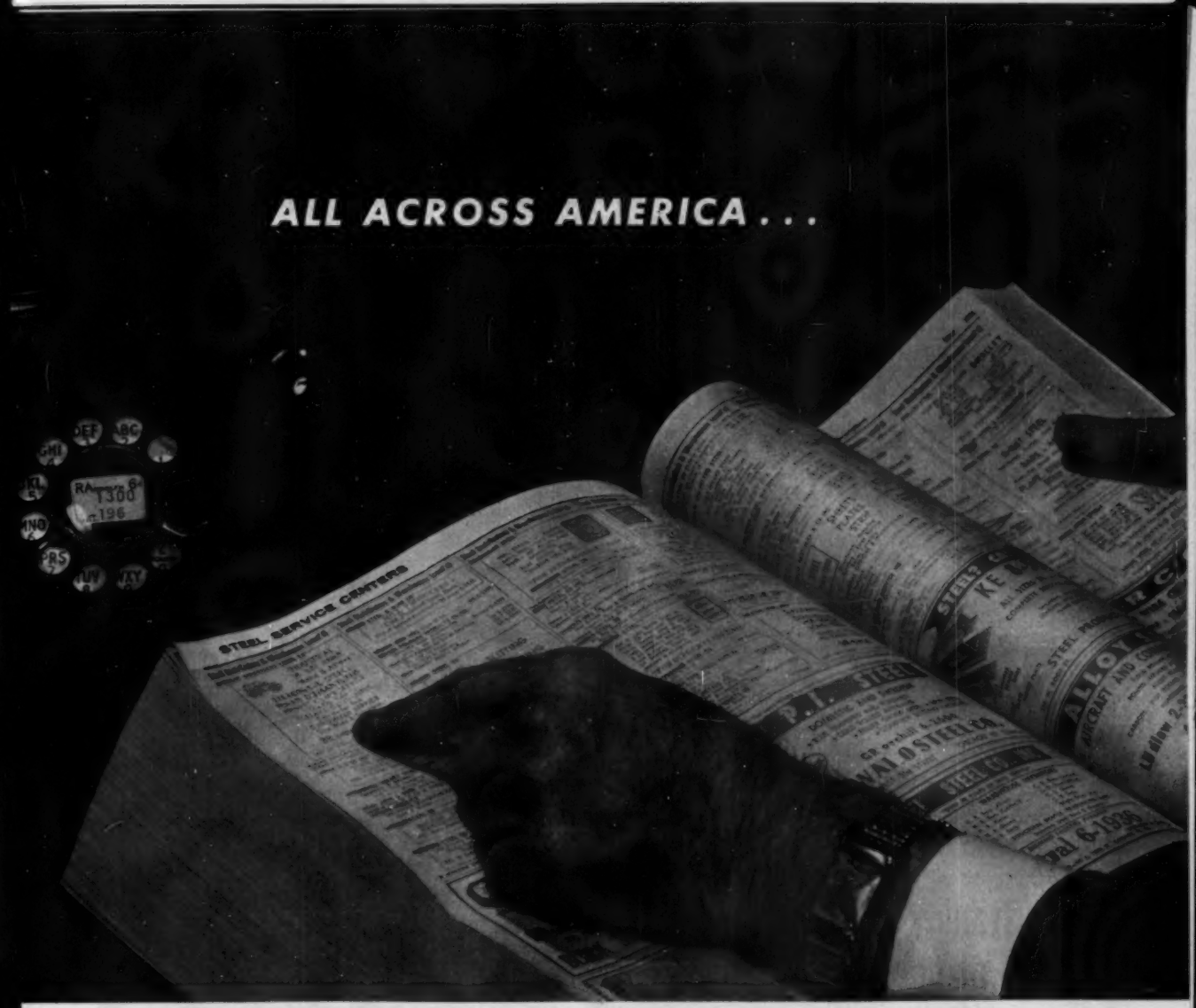

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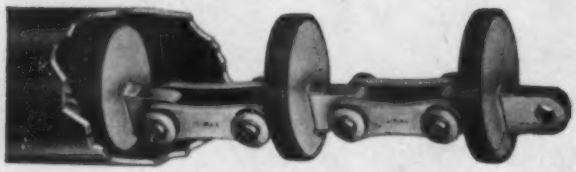

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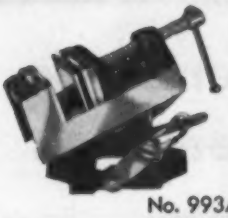

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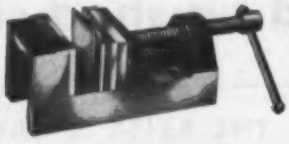
3" Jaws



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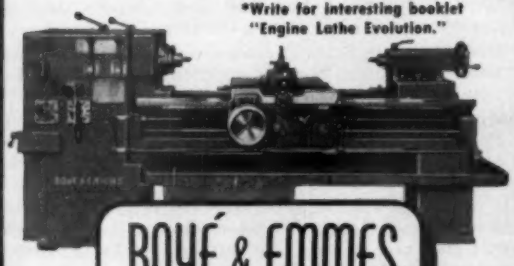

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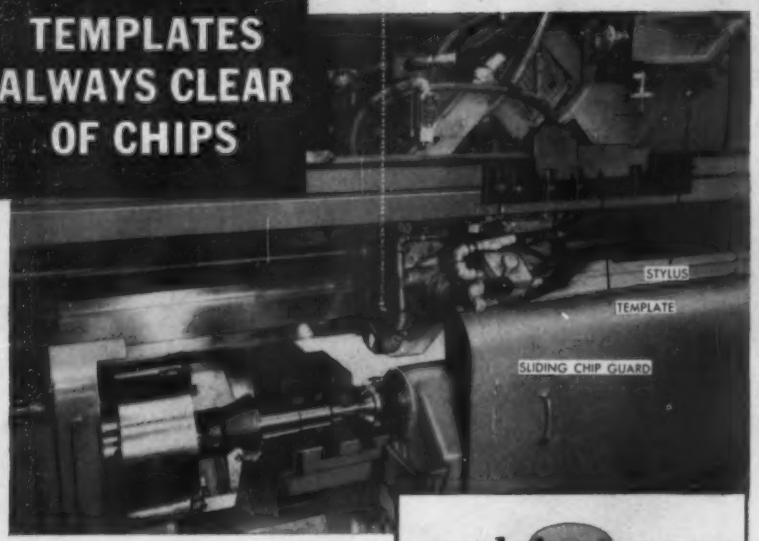

Another advantage of the Seneca Falls Model Q Lathe is its strikingly practical design which recognizes the user's problems. Production turning machines produce chips. Chips can be an awful pain. So we put the template and stylus where chips can't interfere with the amazing accuracy built into Model Q. Likewise you will find efficient chip guarding, adequate chip flow area, and practical chip disposal means are other features of this unusual lathe.

Write for Bulletin Q-59 for the full story.

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- Multiple tools rough and tracer tools finish turn in one automatic cycle.
- Mechanical feed to all carriages.
- Templates clear of chip area.
- Easy to load and unload.
- Straight line diameter adjustment for tracer tools.
- Four speed headstock available with automatic speed change.
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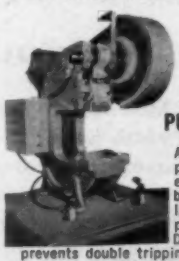

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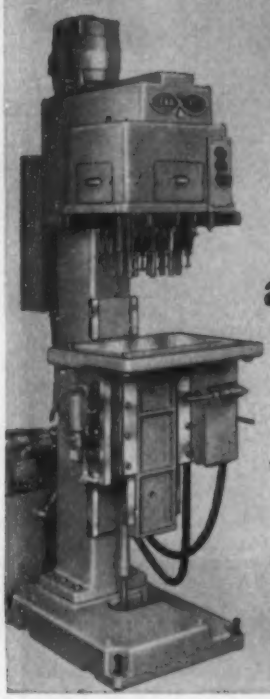

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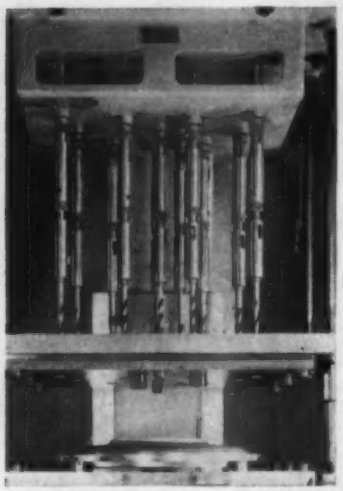

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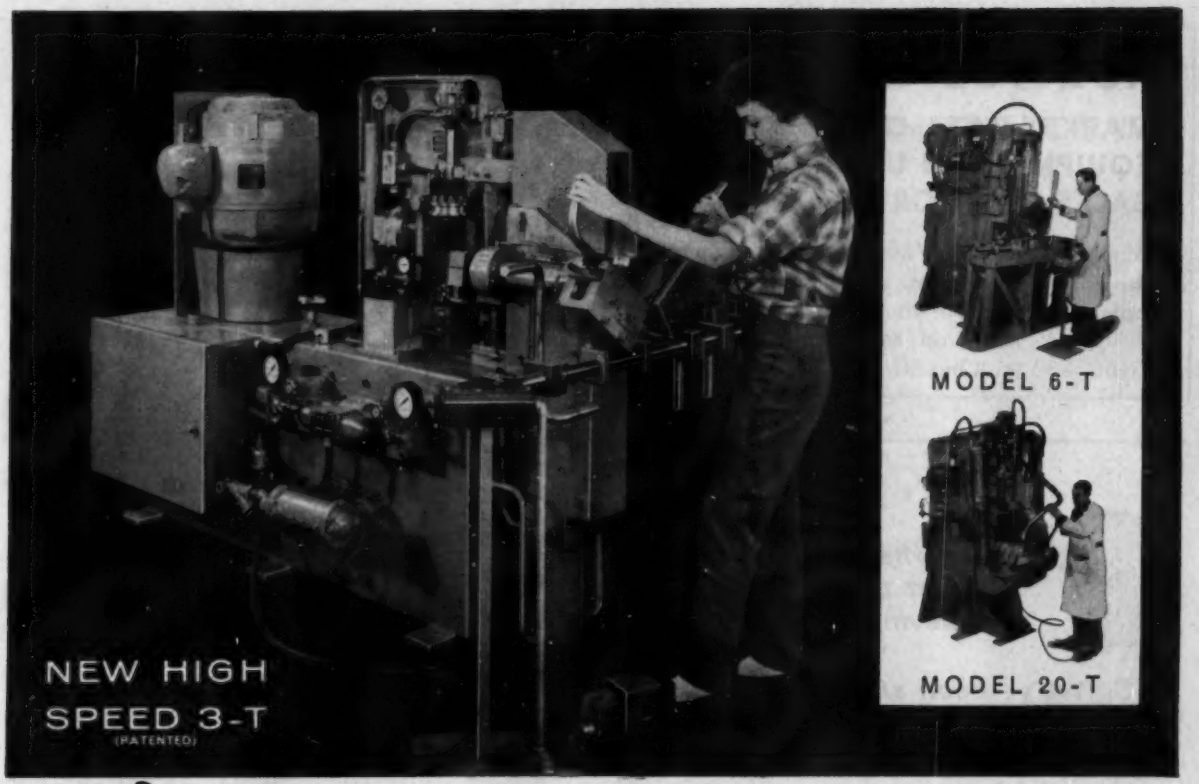

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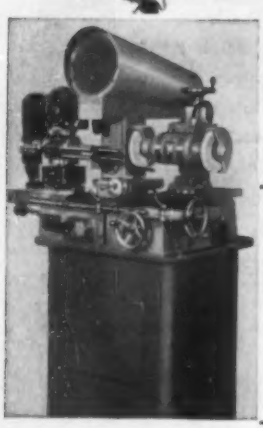

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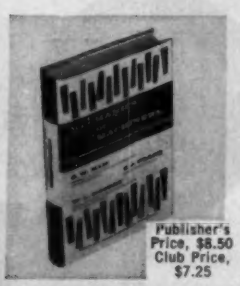

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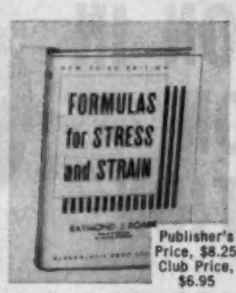

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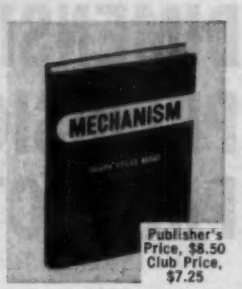

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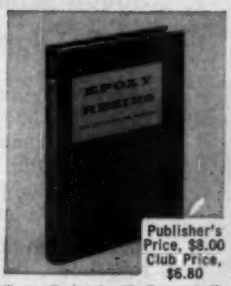

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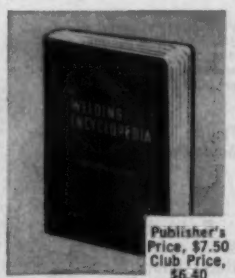

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Reduces costs — cuts machine downtime, saves operator time, speeds production, reduces scrap, speeds operator training. ***Improves quality*** — eliminates transfer errors, allows working to layout, permits seeing and measuring stock removal. ***Broadens market*** — allows you to do work you otherwise would not be able to do.

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CIRCLE 344 READER SERVICE CARD

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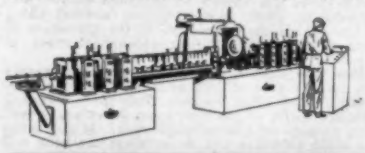

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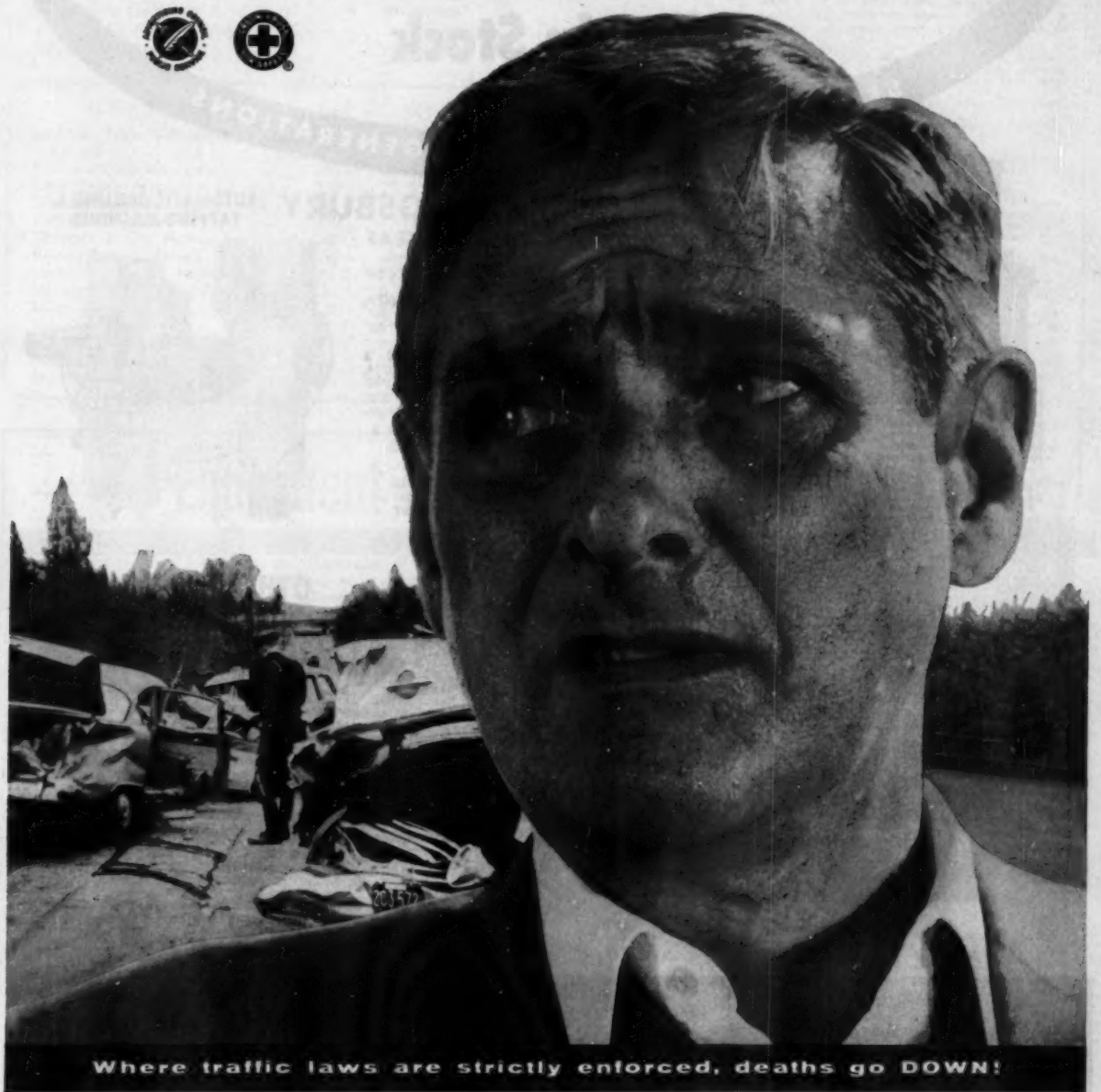

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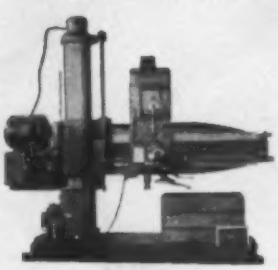

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Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name, indicates the products or services offered by the advertiser.

1. Accessories
2. Automatics
6. Boring Mills
7. Broaching Machines
10. Chucking Machines
11. Compressors
13. Cutting Off Machines
16. Drilling & Reaming Machines
17. Electric Motors
20. Forging Equipment
23. Gear Cutting Machines
24. Grinding Machines
29. Lathes
33. Milling Machines
37. Planers
39. Power Equipment
40. Press Brakes
41. Presses
46. Roll Formers
48. Saws
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51. Shears
56. Threading & Tapping Machines
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Drills, Multiple, Model B2A Natco "Helastael" hyd. 3-way
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Drill, No. 28 H.D. Baker hy. dy.
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Lathe, Engine, 25"x72" cc Axelson Model E hy. dy.
Grinder, Thread, No. 35 Ex-Cell-O automatic
Lathe, Automatic, 15"x42" cc Monarch Magnamatic
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Mills, Rotary, 54" Newton 2 spdl. MD
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Press, Hyd. 100 HPM "Hydropower" 4 post
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Rolls, No. 30 Waterbury Farrell, thread roller
Cut-Off, Radius with 1½ HP motor
Shaper, 6" Model B P&W vertical
Shaper, 36" Rockford hyd. vertical
Tester, 230,000 inch-pound Tinius Olsen No. 2, torsion
Threader, Type R Economy automatic pointing or threading
Upsetter, 4" National air clutch
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Gear Checker, No. 20 M Fellows Red Liner
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Cimco

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20" Gould & Eberhardt Industrial Shaper, vise, front support, new 1947

22" x 24' centers Monarch Model CM Geared Head Lathe, actual swing 27½", 16 speeds, two Carriages, tapers.

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Cincinnati Machinery COMPANY

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Put into Service 1945
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SAVE, SAVE SAVE, SAVE

1953 SPRINGFIELD VERTICAL UNIVERSAL INTERNAL GRINDER

22" Swing
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Rocket Development Department

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   b. Load carrying components
2. Load deflection measurements
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W. D. Linkenhoker
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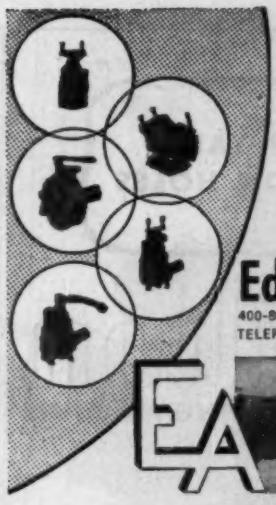

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No. 2 Avey Style MA1, with horizontal operation
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No. 2F1 Natco Horiz. Boring & Drilling Machine Natco, Holecteel Model, m.d.
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FOR SALE — FROM STOCKS

RBG = Rebuilt Condition & Guaranteed
RCG = Reconditioned — Guaranteed
*Indicate Late Model Machines

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1⅝"—6 Spd. Conomatic (1954) RCG

BORING MILLS
*24" Bullard VTL, Side Head, Coolnt Rebuilt
*74" Bullard VTL, "Cutmaster" Like Rblt

DRILLS, RADIAL
*3'x11" Carleton, Tapping Sor 1A822 RCG
*4'x11" Amer "H Wizard" Tbl. (1948)
*5'x11" Carleton #4 MT, Ser 1A1418

DUPLEX BROACH
5 ton—42" Cine. Vert. Hydro (1950) RBG

GRINDER, FORM
#180 Sheffield, Ser 180448—like new

GRINDERS, MISC.
#35 Excello Thread, 3 way dresser, RBG
100 Bryant Int. New Spdl. (1947) RBG.
*30x48 Landis CHW Universal 1952

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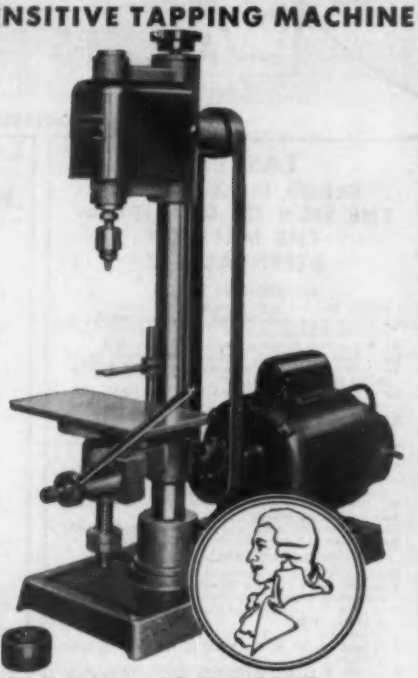

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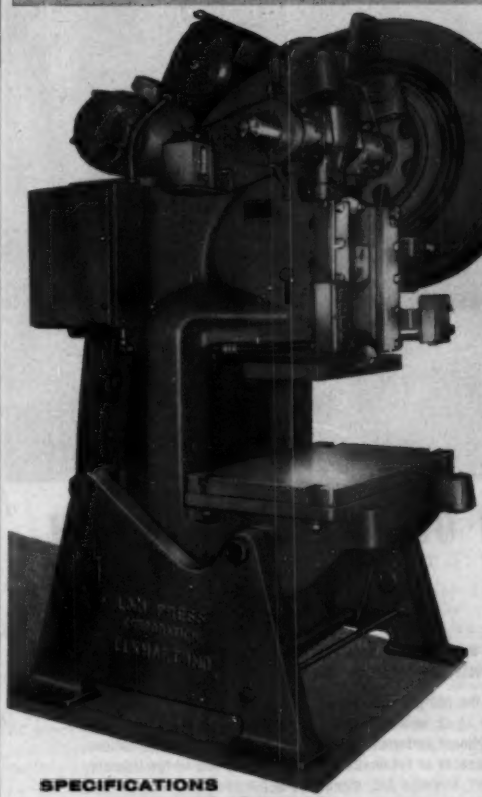

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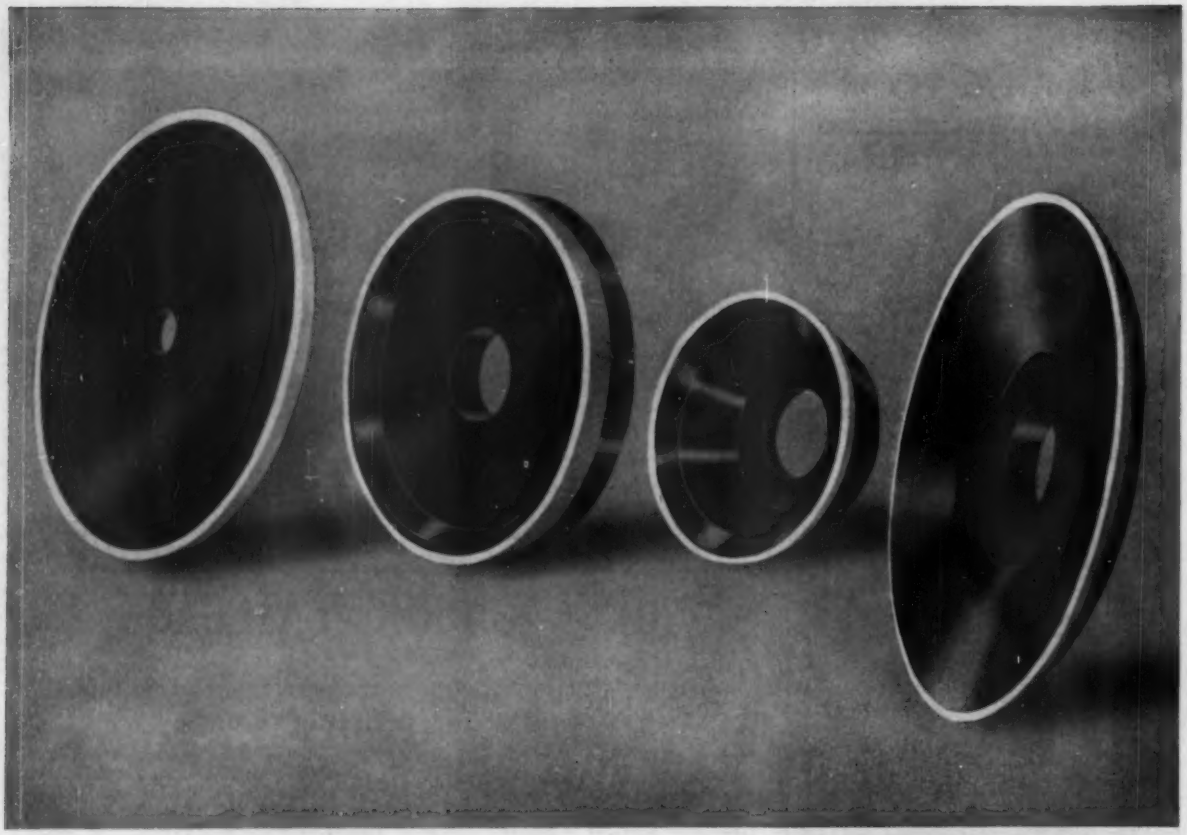

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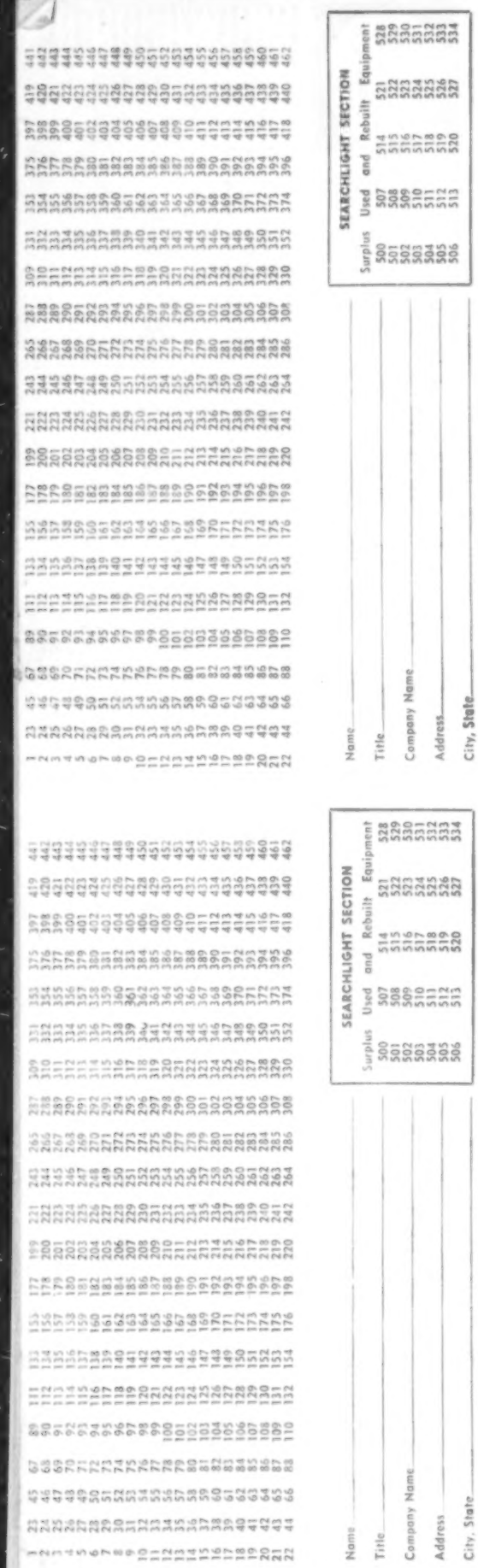

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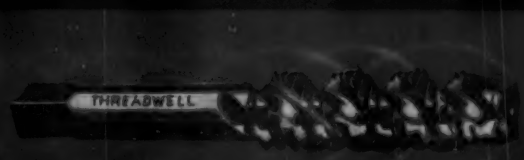

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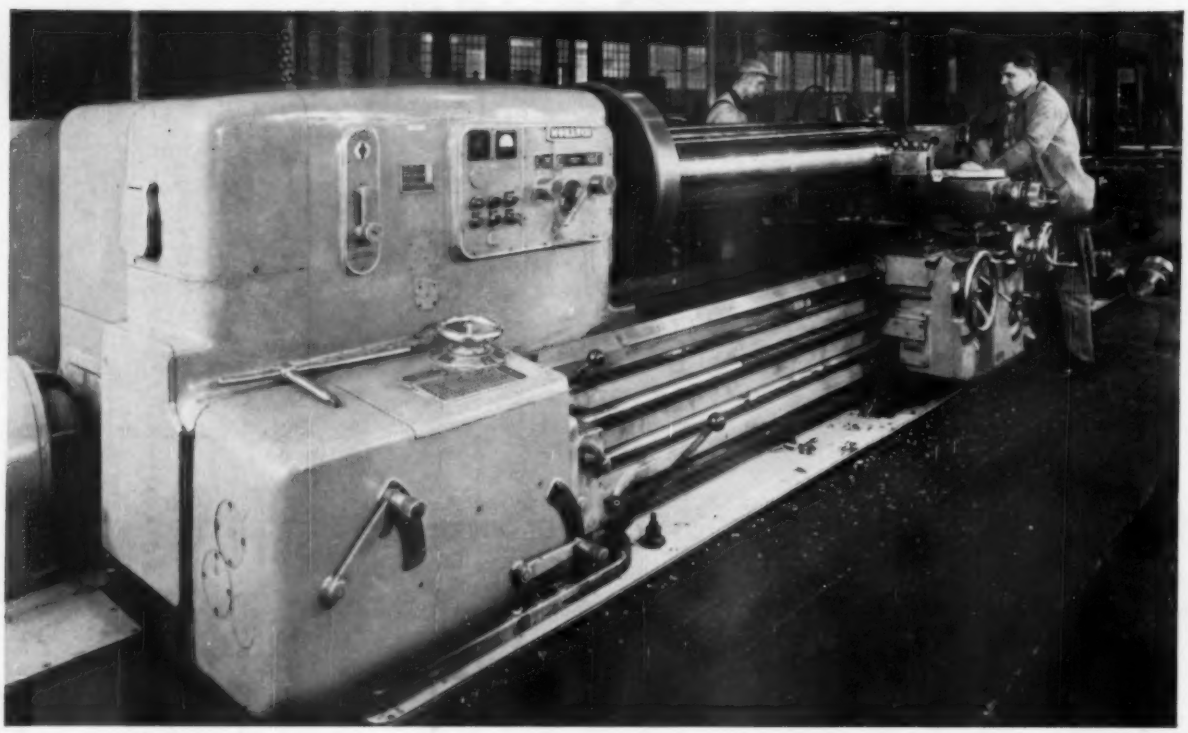

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